# CLINICAL LECTURES
ON
# INFANT FEEDING

*Boston Methods*
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# PREFACE

As these lectures represent a somewhat new method of postgraduate medical education in this country, the history leading to their development may be of interest. The plan originated with Dr. W. S. Rankin, Secretary of the Board of Health of the State of North Carolina. He conceived the idea of bringing the medical school, in the person of a traveling lecturer, to the doors of the physician, enabling the latter in this way to continue with his practice instead of being compelled to leave it for several months while he sought postgraduate education in one of the large medical centers. Upon hearing of this scheme, President E. K. Graham, of the University of North Carolina, gave it his enthusiastic support, and courses were arranged under the joint auspices of the University and the State Board of Health. Two sections of six classes each were organized, one in the eastern part of the State, one in the western. Each of us had six towns in his circuit, and traveled each day to a new town, returning to the first one at the beginning of each week.

One of us was trained in the methods used in Boston, the other in Chicago, with postgraduate work in Europe. As a result of this dissimilarity in our training the lectures differ a good deal, and it occurred to us that it might be of value to combine the two sets in one volume, so that the teachings of two somewhat different schools of infant feeding may be compared.

Each of us has prepared and presented his course of lectures independently of the other and without knowledge of the other's methods and plans. It is with a spirit of coöperation rather than rivalry, of construction than destruction, that we offer them to the profession.

Lewis Webb Hill
Jesse R. Gerstley

September, 1917

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LEWIS WEBB HILL, M.D.

# CLINICAL LECTURES ON INFANT FEEDING (BOSTON METHODS)

## LECTURE I*

## INTRODUCTION TO FEEDING IN GENERAL

Pediatrics, or the study of diseases of children, is naturally divided into a number of sections, of which the most important is the feeding of infants and the treatment of the diarrheal diseases of infancy.

My lecture today is somewhat of an introductory lecture, taking up breast feeding and a short introduction to artificial feeding. It is my purpose to make these lectures as *practical* as possible, and to touch upon theory and chemistry only so much as is absolutely necessary—as I am fully aware that you are a practical group of men, dealing every day with *sick people*, and not with theories, chemical names, and formulæ. It is, however, necessary for us to consider a few fundamental chemical facts upon which modern infant feeding is based before we can go on to the more practical portion of the subject.

I am going to teach you "percentage feeding," which is used more in Boston than in any other city. In the old days of infant feeding there was no science of any sort; a little milk and water was mixed and fed to the baby, without knowing what he was getting of food value; of fat, sugar, and protein. Some babies got along very well on this, but as you know some will get along on almost anything, whereas some need the utmost care.

Dr. T. Morgan Rotch, of Boston, about twenty-five years ago, devised the so-called percentage method. This means that in a baby's milk certain *elements* have to be recognized. The

* Sixteen lectures were given in the course. The other nine lectures dealt with the general diseases of children.

food elements of milk are, as you know, fat, sugar, and protein, and it is desirable to know how much of each the infant is getting, because digestive disturbances of all sorts are likely to be due to too much or too little of one element or the other in the milk. These ideas simplify the whole matter of feeding because the physician can tell so easily with what he is dealing. There is no reason why a baby should not have its milk made up in just as accurate a way as a prescription is made up. With adults it is not necessary to regulate the food so carefully, because an adult's digestion is stronger, and small things will not upset it so easily. The percentage method of feeding consists simply in writing a prescription for the baby's milk according to the indications, knowing approximately how much of each food element the prescription contains, the most convenient way of expressing the quantity of these elements being in percentages.

As an introduction, I think I cannot do better than to read a few lines written a short time ago by Dr. Ladd, of Boston:

"Now, whatever our method of making a food for infants, in which milk is the basis, we are making a modified milk containing certain percentages of the elements. Percentage feeding presupposes that these alterations have been made by the physician with design and with a definite knowledge of the end-result of his changes. By the old method milk was modified quite as much as by modern methods, but with this fundamental difference: that the physician had not the slightest conception of the composition of his mixture, and hence no check upon his results. Without a knowledge of the percentage composition of the milk it is next to impossible to give a lucid and intelligent expression of its food value. A mixture expressed as so many ounces of cream, milk, lime-water, sugar, and water may exactly fulfil the requirements of an individual infant, but unless I can express such a formula to a student in percentages or calories, or both, my exposition of the principles on which I have acted in prescribing such a formula is vague and indefinite.

"Whatever we may feel about the relative values of fats and sugars and proteins, and the proportions best suited to individual conditions, the percentage method of thinking, writing, and prescribing should not and does not complicate the question. In fact, it simplifies it enormously, for it furnishes us the means for accurate estimation of food values, and only by such knowledge can we intelligently check up our results when struggling with the problem of adapting a food to the individual requirements of an infant.

"If one will grasp this simple idea of percentage feeding, one will disabuse one's mind of the conception, so erroneously held, that percentage feeding is ultra-scientific, very mathematical, complex, and impractical for the average practitioner.

"I wish to emphasize the fact that the purpose of percentage feeding is, on the contrary, to simplify the sometimes very difficult question of finding

a food which the infant will digest and upon which it will gain normally in development. The mathematics involved in the calculation of percentages are of the simplest—a mere matter of proportions. If properly presented, any one of half a dozen in vogue is easily mastered and perfectly practical. It does not matter by whose methods one works to gain this fundamental knowledge of how to calculate the percentage elements of the food, so long as that method is thoroughly mastered. Some methods are simpler to understand than others, and any method requires some study and practice, but this hardly offers an excuse for ignorance of the subject. Any third-year medical student may in two hours be taught a practical way of calculating percentages and estimating the caloric value of any mixture. Such knowledge is rudimentary but fundamental. Any physician who pretends to feed scientifically should not shun the task of acquiring this knowledge, any more than he should avoid the labor involved in grasping the technic of simple surgical or bacteriological procedures, in order to become more skilled in the practice of modern medicine. Too much is written of the difficulties of these methods of calculation by men who have been too lazy or indifferent to learn them; too little has been written about the responsibility of the physician to master them in order to become a more efficient worker along the lines of modern infant feeding."

That is a very good summing up of the question of percentage feeding. *In a nutshell, it is necessary to know, in any milk mixture which is being fed to a baby, approximately how much fat, how much protein, and how much sugar it contains.*

In order to do this it is necessary to know the composition of milk.

Human milk contains 4 percent of fat, 7 percent of sugar, 1.6 percent of protein, and about 0.2 percent of salts. Cow's milk contains 4 percent of fat, 4.5 percent of sugar, 3.2* percent protein, and 0.7 percent salts. Now, different specimens of human milk vary a great deal. Different cows' milks also vary a great deal, but these are the average figures.

Besides the quantitative differences, there are also certain qualitative differences. The fat in the milk is in the form of an emulsion; the sugar, protein, and salts are in solution. The globules of fat in cow's milk are much larger than in human milk. The sugars are exactly the same.

In all milks there are two kinds of proteins—casein and albumin or whey protein. In human milk there is more whey protein than casein. The ratio is about three to one. In cow's milk there is more casein than whey, and this is one reason why

* These figures are not absolutely correct, but are near enough for practical purposes.

cow's milk is so much harder to digest, because the casein protein is coagulated in the stomach into tough curds. The whey protein is not. The salts are qualitatively about the same in both milks, the most important being salts of sodium, potassium, magnesium, calcium, iron, phosphorus, and sulphur. The salts are of extreme importance in the nutrition of every baby, but we cannot take them into practical quantitative consideration in feeding a baby, so let us consider the three elements—fat, sugar, and protein. It is very important to bear in mind this composition of milk.

Now I want to run over very briefly the digestion of the different food elements. First, the fat—it is not acted upon to any great extent in the stomach. Chemically it consists of a fatty acid in combination with glycerin, forming a so-called "neutral" fat. After leaving the stomach it enters the intestine, where it is split by the pancreatic juice into glycerin and a fatty acid. The fatty acid combines with an alkali in the intestine, forming a "soap." This is acted upon by the bile, which emulsifies it, and it is then absorbed. The absorption of fat is usually very good. Often 90 or 95 percent of the fat taken in will be absorbed by a well baby. In other cases as little as 30 or 40 percent will be absorbed, and most of the fat will come out in the stool in the form of "soaps."

The sugar is acted upon very little in the stomach. Milk-sugar is what is known as a disaccharid, that is, a complex sugar. In the intestine it is split into simpler sugars and absorbed as such. The absorption of sugar is usually extremely good, and it is very rare to find any in the stools of infants. Sugar may sometimes remain in the intestine, and may be broken up by the bacteria in the intestine into acids, as acetic acid and butyric acid. Fats may also be broken up in this way.

Next comes protein. Protein is partly digested in the stomach, where it is coagulated by the gastric juices. Digestion is carried on further in the intestine by the pancreatic juice and the secretions of the intestine, and the end-products are absorbed as salts of the amino-acids. An important point which I wish to emphasize is that in the intestine of every infant there are always two forces working against each other. That is, the end-products from the breaking down of fat and sugar are acid

in reaction; those from the breaking down of protein are alkaline in reaction, from the ammonia which is formed. The normal reaction of a child's stool is slightly alkaline, slightly acid, or neutral, and if there is too great acidity or too great alkalinity, trouble results. It is very important to have such a balance between the fat and sugar and the protein in the food as not to have too great acidity or too great alkalinity in the intestine.

You have all probably heard a good deal of discussion about "calories." What is a calorie? Of course, all food is fuel. The different elements of food have different fuel value, and we measure this fuel value by calories. A calorie is the amount of heat that is necessary to raise one liter of water one degree centigrade. This is a "large" calorie, which is the one we use in infant feeding. The average baby needs about 50 calories per pound of body weight in order to thrive. The different food elements produce different amounts of these calories. Fat produces 9.3 calories per gram; protein and sugar each produce 4.1 calories per gram.

That covers the bare essentials of the theoretical part of our subject, and although it may sound rather complicated and not very practical, it is necessary to understand the scientific groundwork upon which rests the practical superstructure of our ideas of infant feeding.

## BREAST FEEDING

In regard to breast feeding, *it is an axiom that every baby should be fed upon the breast if possible.* Of course, there are a good many women who cannot nurse their babies, but it should be insisted upon that every woman who is able should nurse her baby through the first year. Breast milk produces the big, robust babies, and babies who are breast fed have very little chance of developing the gastro-intestinal troubles of various sorts which bottle-fed babies are so likely to have, especially in the summer. Of course, in some cases a baby must be weaned, but these cases are comparatively few. *Persist in breast feeding, and do not take the baby off the breast merely because it perhaps vomits once or twice or does not gain on the breast milk.* If a mother has not enough milk, try to find out why. Look after

her habits, see that she leads a reasonable, quiet life, that she is not worried or nervous about anything, and that she gets a proper diet.

Another thing: sometimes the milk is late in coming into the breast. Normally, after a baby is born it comes into the breast in from twenty-four to forty-eight hours. Sometimes it is delayed for four or five days. However, don't take the baby off the breast because the milk is late in coming.

How is a new-born baby to be fed? It may be put to the breast six hours after birth. This may not furnish much nourishment, but it teaches the baby to suck, and it stimulates the breast to produce milk. For the first twenty-four hours the baby should be nursed every six hours; for the next day, every four hours; for the first few weeks after that, every two hours.

There is a great deal of discussion in all the pediatric centers about the intervals between nursings, but I really think most of the intervals—that is, two, two and one-half, three, or four-hour intervals are reasonable. Most normal babies get along well on any of those intervals. Personally, I think it is best to have a normal baby nursed every two hours during the first month; for the next three months every two and one-half hours; after this, every three hours. It is a good thing to have the baby take one bottle a day. This gives the mother more time to get out and take exercise than if it has to be nursed every time.

If the bowels of a new-born baby have not moved well soon after birth, it is wise to give a small dose of castor oil, because the meconium may undergo decomposition and make the baby ill from toxic absorption, so it is important to clean it out artificially if it has not cleaned itself out naturally.

It is important to have the baby nursed regularly, and not every time it cries. Have this distinctly understood by the mother. If the baby is asleep at the time of nursing, it should be waked. It is better to give the baby alternate breasts each feeding rather than a little out of one and a little out of the other, for if one is used for each nursing it will be emptied, and thus stimulated to the production of more milk.

An average baby will empty the average breast in about fifteen minutes; of course this time may vary, but that is usually the average. A baby does not take the same amount of milk from a

breast at each nursing, and at some feedings it will take only one or two ounces, at others six or seven. This is not very important, however, because most babies get the same amount every twenty-four hours. If little is taken at one feeding, it will be made up at another. The twenty-four-hour amount is the important thing to consider. Sometimes it is important to know if a baby is getting enough milk in a day, and the best way to learn this is to weigh the child before and after each nursing. Take the difference between the weights before and after nursing, add them all together, and the result will be the number of ounces the baby is getting in a day, as an ounce of milk weighs about an ounce.

It is true that every baby should be fed on the breast, but it is also true that there is abnormal breast milk—bad breast milk. There are four kinds of bad breast milk. The first kind is too rich—it has too much of every food element. This type of milk is found in certain women of the upper classes usually, who eat too much rich food and who do not take enough exercise. The second type is one in which the fat and sugar are low and the protein high. This sort of milk is seen in the poorer classes of women who do not get enough to eat and who have to work too hard. The third type of milk is one in which the fat and sugar are very low and the protein very high. This type of milk is usually found in excessively neurotic women. The fourth type of milk is that in which, by repeated chemical analyses, it is found that every one of the elements is in perfect proportion; but which, for some reason or other, the baby cannot take. I do not know the cause, but it is unquestionably true that in the milk of some nursing women a toxic substance is secreted, and this upsets the baby. In one case I analyzed the milk three times and found it perfectly normal, but the baby could not take it at all and had to be weaned. Of course, in considering this type of milk it must be taken into account that the trouble may be in the baby and not in the milk, and that the milk might be perfectly suitable for some *other* baby.

This type of milk is not common, but it is certainly seen sometimes. It ought not to be assumed, however, that a milk is of this sort until the nursing mother has been given a very thorough trial and until the milk has been analyzed, if possible. Never

give up nursing until every means has been tried of modifying the mother's milk and making it better.

How may the chemical composition of a nursing mother's milk be modified?

When a woman has too rich milk, the important things are to take her outdoors,—make her exercise,—keep her bowels open, cut down on her diet, and make her drink plenty of water. In the other type, where the milk is too thin, ease up the woman's home life, have her arrange to get some one to do part of her work, and have her eat more, especially fatty and starchy food. If the *quantity* of milk, on the other hand, is too little, have her drink plenty of fluid. I have many of my nursing mothers take corn-meal gruel at night before going to bed. It is of no use, however, to give more than three or four pints of fluid a day; anything over this does more harm than good. Another thing, and probably the most important of all: *use* the breast. *There is nothing which will stimulate milk production so well as a complete emptying at each nursing.* If the baby is weak and small and does not empty the breast, pump it out. There is no *drug* with which I am familiar that will increase milk secretion.

As to the diet of the mother: I think the best thing to tell a nursing mother in average circumstances is to eat exactly what she would if she had no baby at all, provided she is taking a reasonable diet. Undoubtedly there are certain things which may be eaten by a nursing mother that will influence the milk and upset the baby. Cabbage, strawberries, and certain other fruits and vegetables sometimes do this. Babies generally get on well, however, if the mother is healthy and eats an average ordinary diet.

How much should a normal breast-fed baby gain? It should be weighed every week, so that its progress can be followed, and the food corrected, if necessary. The normal breast-fed baby should gain six to eight ounces a week for the first five months of its life. For the rest of the first year it should gain four to six ounces a week. If it does not gain as much as this, there is something wrong. The weight of a baby is one of the best indices we have to determine whether or not it is thriving, and the weighing of babies is neglected in altogether too many cases.

The breast-fed baby usually has three or four rather loose, golden-yellow, sour-smelling movements a day. Those fed on cow's milk usually do not have so many.

Certain babies may have more than others and the stools may be green in color and smell bad. The baby may vomit a little. But if it is getting on well in every other way and is gaining weight, it is best not to pay too much attention to this.

Let us take up the abnormal breast-fed baby, the baby who is not gaining on the breast, who has a good deal of colic, who does not sleep at night, who vomits often, who has bad movements; and the thin, poorly nourished, breast-fed baby who does not get enough to eat. These troubles may be due to a number of causes. If a baby does not gain, but has no symptoms of indigestion, the milk may not be rich enough or there may not be enough of it. In cases like this substitute feedings should be given after a trial has been made to increase the amount and richness of the milk. Modified cow's milk can be given after each breast feeding, or it can be substituted in alternate feedings with the breast. It is a little better to give it after each breast feeding, because cow's milk is better taken care of in the stomach when it is mixed with human milk.

When a baby has colic, when it is fussy most of the time and does not gain, the milk is probably too rich, or too much is taken at a feeding. It may contain too much fat or protein. The sugar in human milk gives very little trouble. The symptoms of fat indigestion are vomiting of creamy, thick, sour-smelling material, diarrhea, failure to gain, and fussiness. The symptoms of protein indigestion are the same, except that the vomitus is not quite so thick and creamy.

Treat these conditions by treating the mother in the first place, by taking her outdoors, having her walk, take exercise, and by getting her to drink plenty of water. In the second place, keep the baby quiet after each nursing. Do not let the mother shake it up and down, as so many do. Also, it is a very good idea to give a tablespoonful of boiled water to dilute the milk. Again, it is well not to let the baby nurse too long. It may be getting too much milk. Sometimes if the intervals between nursings are increased, it will help these cases.

As to colic, the treatment is to prevent it, if possible, by regu-

lating the feeding. The best thing to do during the attacks is to give a suds enema, hot applications to the abdomen, half a soda-mint tablet, a few drops of gin or aromatic spirits of ammonia, or peppermint water.

A very common cause of disturbance in breast-fed babies is irregular feeding intervals. Many mothers nurse their babies every time they cry, and thus they are fed sometimes every half-hour, sometimes every three hours. Such feeding as this is bound to cause trouble; the usual symptoms are failure to gain, fussiness and sleeplessness, colic, vomiting, and the passage of an increased number of loose stools, which may be green. Oftentimes it is surprising to see how much may be done for babies of this sort simply by regulating the nursing periods.

Many babies have the same sort of symptoms because the mother is upset or worried about something or because the household is in confusion. *A nervous mother and a nervous household make a nervous and unstable baby*, and many babies may have severe symptoms of indigestion and may fail to gain in weight for a number of weeks until calm and quiet conditions are restored in the household. The mother should be in a quiet room, without any noise or confusion around if possible, when she is nursing her baby; and after the nursing, it should be put into its bed and *left alone* for half an hour. Some babies may swallow a good deal of air when they nurse, and with these babies it is a good idea for the mother to interrupt the nursing every two or three minutes and hold the baby up against her shoulder, slapping its back gently, to give it a chance to get rid of this swallowed air, which may cause colic.

There are certain indications for weaning. Many mothers have the idea that if menstruation starts the baby should be weaned. This is not so. Sometimes menstruation in the mother does upset the baby temporarily, but it will probably be right again in a day or two. If a nursing mother becomes pregnant, however, the baby should be weaned immediately in most cases. Women with any wasting disease, such as tuberculosis, cancer, or chronic nephritis, in most cases should not be allowed to nurse their babies. It is also best to wean the baby if the mother develops any severe acute illness, such as typhoid fever or pneumonia. If the mother has a "cold" or

slight tonsillitis, it is best to discontinue nursing for a day or two, or perhaps in some cases not to discontinue it entirely, but to substitute bottle feedings for half of the breast feedings.

If a mother cannot nurse her baby, it is often a very great advantage to get a wet-nurse. What are the qualifications of a wet-nurse? In the first place, how is the wet-nurse's own baby? If it is doing well, the chances are that the other baby will do well. No one should be taken whose own baby is over eight or nine months old, because after this period the milk becomes thin and poor in quality. Every nurse should have a thorough physical examination to exclude tuberculosis and syphilis. A Wassermann should be done on the blood of every wet-nurse if possible.

## ARTIFICIAL FEEDING

In artificial feeding, what kind of milk is to be used? There is another axiom in pediatrics, and that is that *no milk is too good for a baby.* Get the very best milk possible. Get it from a good dairy, from a farmer who takes care of his barns and his cattle and who is interested in producing good milk. There is nothing that causes so many babies to die as unclean milk. Milk is really one of the dirtiest things in the world, because of the conditions under which it is produced and the ease with which bacteria grow in it.

A handful of dirt may be thrown into a bottle of milk and it cannot be seen. What looks like clean milk may be centrifuged and a large amount of dirt may be found as a sediment. An Ayrshire, Holstein, or plain ordinary "cow" is usually the best cow from which to procure the baby's milk. Many of the laity prefer a Jersey, but Jersey milk is too rich. The fat may often run up to 6 or 7 percent, and the baby may get into a great deal of trouble on account of this high fat percentage.

A baby may be fed on raw milk or on pasteurized or sterilized milk. I have no hesitation in saying that every milk fed to a baby should be pasteurized or sterilized, especially in a warm climate like this, unless it is what is called "certified" milk. Certified milk composes less than 1 percent of the milk supply of great cities. It is produced under the greatest precautions. The cow is washed off before milking, the milkers wear white

gloves, the barns are sanitary, and every possible precaution is taken to produce good milk. But, of course, such milk is only a very small proportion of the milk supply, and the milk that babies get should in practically all cases be sterilized or pasteurized. *Insist upon this.* I do not know much about the milk supply of North Carolina, but I think it would be a great deal better if it were pasteurized or sterilized before being fed to babies, and I hope that you will all feed all your babies on pasteurized or sterilized milk this summer.

There has been a great deal of objection to pasteurized milk because some people think it is harder to digest. This is not so. Some people say that it tends to constipate the baby. But what if it does? A slight amount of constipation is better than dysentery. Some people say, too, that it is too much work to pasteurize milk, but it is really not very much more trouble. The greatest objection is that pasteurized and, more especially, sterilized milk may produce scurvy; but this is not much of an objection. Scurvy can be cured in a few days by the use of orange-juice, and it can be prevented by the use of two tablespoonfuls of orange-juice a day. In Boston nearly all milk fed to babies is pasteurized except the certified milk. The latter costs twenty cents a quart, and is therefore out of the question for most people. Pasteurization is not an excuse for bad milk. Milk, whether pasteurized or not, should be good milk to start with, if possible.

What is the difference between pasteurization and sterilization? They are two different processes. Pasteurization consists of heating milk to 145° F. and keeping it at that temperature for thirty minutes. This does not kill the ferments in the milk, but it does kill almost all the bacteria except the spore-bearing bacteria, of which the gas bacillus is the most important. Sterilizing milk, on the other hand, consists in boiling it, which kills all the bacteria.

A great many devices for pasteurizing milk have been put on the market, which are convenient, but not at all necessary. Milk may be very efficiently pasteurized with a simple home-made apparatus as follows:

Put the milk bottles and some warm water into an ordinary tin pail and heat until the temperature of the water is 145° F.

Then take the pail off the stove, put a small doubled-up blanket over it, and let it stand for half an hour. Pour off the hot water and fill the pail with cold water in order to cool the milk as quickly as possible, as spores develop very readily in lukewarm milk.

Sterilization consists in boiling the milk for four or five minutes. Whether or not sterilization or pasteurization should be employed depends largely upon the sort of people one is dealing with. If they will take the trouble to do it, pasteurization is better.

If a baby is fed on pasteurized or sterilized milk, it should be given orange-juice as a prophylactic against scurvy. The best way to give this is in two doses, a tablespoonful morning and night. It is best given about an hour before feeding.

I have mentioned a number of times the "modification" of milk. Just how is milk to be modified? The modification of milk consists in adding water or other substances to cow's milk to change it to suit the digestion of the individual baby that is being treated. What is of the utmost importance to remember is *to fit the milk to the individual baby.* There are no definite rules or laws that can be laid down, because babies vary so much in what they will take and in their digestive capacities, but there are certain broad principles which may be followed in a general way.

There is no question but that the average practitioner feels helpless when it is a question of milk modification, and the reason for it is this. Every man who writes a text-book of pediatrics has a different method of milk modification, and usually gives complicated formulæ and long tables which he himself understands perfectly, but which are usually hopeless for the average practitioner to carry in his mind. Thus great confusion has arisen: there are so many different methods. I feel very strongly that tables showing how much milk, water, etc., should be mixed to feed a baby of a given age should be used as little as possible. In the methods I am going to teach you one remembers about what percentages should be fed to a baby of a given age; then he figures by the aid of certain data which can be easily carried in the head the amounts of milk, cream, water, and sugar to use to make up the desired formula. Thus multitudinous formulæ and tables are largely done away with.

I am going to teach you *two* slightly different methods of modifying milk, which I am sure you will find very simple of application: the "gravity" cream and skimmed-milk method and the "whole" milk dilution method.

Top or "gravity" cream is all the cream that is visible in a quart of milk in an ordinary milk bottle after the milk has stood for about six hours. It is usually about six ounces of cream, and the composition is about 16 percent fat, 4.5 percent sugar, 3.2 percent protein. There are various methods of taking off this cream, which we will discuss later. What is left behind, after taking it off, is skimmed milk, which consists of no fat, 4.5 percent sugar, 3.2 percent protein. These figures are not exact, but they are what we use in calculating our milks. The skimmed milk, cream, water, and sugar are mixed in such proportions as to secure the percentages of food elements that are desired to feed the baby.

The other method of modifying milk consists in diluting whole milk with water and adding milk-sugar to secure the desired percentages. This method of whole milk dilution has one disadvantage, which is that if the milk is diluted enough to reduce the protein percentage to the amount which the baby can digest the fat is reduced too much, and the food does not contain a sufficient number of calories for the baby's nutrition. However, a great many babies do very well on this method, but others do not. Most normal babies will do perfectly well on whole milk and water dilutions, but not many difficult feeding cases can be fed by this method. *In each case the circumstances and the people have to be sized up.* Some people will not take the trouble to take off the cream and to go through the various steps in a cream and skimmed-milk modification. The other method is easier, and if I am dealing with ignorant people I tell them to use this method of whole milk dilution.

In feeding a baby, six things have to be decided:

1. What percentages of the food elements is it to take?
2. How much food is to be given in the twenty-four hours?
3. How much food at each feeding?
4. How often are the feedings?
5. What method of milk modification is to be used?
6. How many calories is the baby getting? Does the food prescribed furnish enough calories to make it gain weight?

## LECTURE II

# THE MODIFICATION OF MILK

As an introduction to the lecture today, which deals with the modification of milk and the calculation of percentages and calories, I can do no better than to quote some words of Dr. John Lovett Morse, of Boston:

> "In approaching the subject of artificial feeding, it must be remembered that there are only a few food elements. A baby's food may contain all these elements; it must contain some of them, it cannot contain any other elements. These food elements are fat, carbohydrate, protein, and salts. It must also be remembered that a baby, in order to thrive and gain, must have a sufficient amount of food. The amount of food, in considering its fuel value, is not calculated, however, in ounces or pints of food, but in food values or calories. A baby must receive a sufficient number of calories in proportion to its body weight, otherwise it cannot gain. It is not sufficient, however, for a food to contain a sufficient number of calories; it must also contain a sufficient amount of protein to cover the nitrogenous needs of the baby. It must further be remembered that a food may contain enough calories and enough protein to cover the caloric and protein needs of the baby, and yet not be a suitable food for any baby, or if suitable for one baby, not for another.
>
> "It is absolutely necessary to fit the food to the digestive capacity of the individual infant. These fundamental principles must be always borne in mind in feeding babies artificially. If they are forgotten, the result is likely to be failure rather than success."

You will remember that I said at our last lecture that there were two methods of milk modification we were going to consider:

1. The "gravity" cream and skimmed-milk method.
2. The "whole" milk dilution method.

I also said that there is more trouble to the first method, but that it is likely to give better results in difficult feeding cases, and that the second method is a good deal simpler to use and more applicable for most patients, especially when they are not intelligent enough to carry out the first method.

Gentlemen, I know that the figures and formulæ we are going

to talk about may seem complicated to you, but I want to say now, before we go any further, that infant feeding is fussy, and that if a man wishes to have any success whatever with it he must be willing to go into considerable detail and take as much pains with his feeding cases as he would take with the most difficult surgical or obstetrical case.

First, let us consider the gravity cream and skimmed-milk method. Gravity cream is all the cream that is visible on a quart bottle of milk that has stood about six hours. This amounts usually, in an average milk, to about 6 ounces. Skimmed milk is what is left behind after the gravity cream has been removed.

Gravity cream has the following composition:

| | |
|---|---|
| Fat | 16.0 percent |
| Sugar | 4.5 " |
| Protein | 3.2 " |

Skimmed milk has the following composition:

| | |
|---|---|
| Fat | 0.0 percent |
| Sugar | 4.5 " |
| Protein | 3.2 " |

These percentages are not *absolutely* correct, but are the ones we use in our calculations, and for practical purposes are near enough.

I am not going to speak of the way in which to take care of the utensils used in milk modification,—you can get this from any text-book,—but will merely say that *the thing of greatest importance is to have all utensils as clean as possible.* There are a number of ways of separating the cream from the skimmed milk, the most practical of which are pouring and dipping. Pouring is the simpler, but not very accurate, and if one is dealing with a family who will take the trouble, it is best to have them remove the cream with a small dipper. The dipper devised by Dr. Chapin, of New York, and known as the "Chapin dipper," is the best, and can be obtained at most drug-stores.

Now suppose we want to prepare a certain formula, let us say:

| | |
|---|---|
| Fat | 3 percent |
| Sugar | 6 " |
| Protein | 2 " |

The amount to be 32 ounces, and the lime-water in the mixture to be 25 percent of the skimmed milk and cream used: how much cream do we need? We want 3 percent of fat—all the fat is coming from the cream; the fat content of our cream is 16 percent, therefore $\frac{3}{16}$ of our mixture will be cream: $\frac{3}{16}$ of $32=6$. Therefore 6 ounces cream will go into our mixture. How much protein did we put in *with* the cream? Cream contains 3.2 percent protein, so if we had made up our complete mixture of 32 ounces with cream *alone*, we would have put in 3.2 percent protein. But we are putting into our 32-ounce mixture only 6 ounces of cream. Therefore we have put in—

$$\tfrac{6}{32} \text{ of } 3.2 \text{ percent} = 0.6 \text{ percent protein.}$$

But we want 2 percent of protein in our mixture. We want 1.4 percent *more* protein. This is to come from the skimmed milk. We want—

$$\frac{1.4}{3.2} \text{ of } 32 = 14 \text{ ounces.}$$

Then we put into our mixture 14 ounces of skimmed milk, giving us so far 20 ounces of cream and milk in all. How much sugar did we put in with this cream and skimmed milk? If we had put into our 32-ounce mixture 32 ounces of cream and skimmed milk, we would have put in 4.5 percent of sugar; but we put in only 20 ounces,

$$\text{So } \frac{20}{32} \text{ of } 4.5 = 3 \text{ percent sugar.}$$

We need 3 percent more sugar, as we wanted 6 percent of sugar in our formula. The deficit is made up with dry milk-sugar. What we want is $\frac{3}{100}$ (3 percent) of 32 ounces. This equals 1 ounce. A rounded tablespoon of milk-sugar equals ½ ounce. Then we put in two rounded tablespoons of milk-sugar. We wanted our lime-water to be 25 percent of the milk and cream used.

$$25 \text{ percent of } 20=5.$$

Then we need 5 ounces of lime-water.

| | |
|---|---|
| Gravity cream | 6 ounces |
| Skimmed milk | 14 " |
| Lime-water | 5 " |
| Water | 7 " |
| Milk-sugar | 2 rounded table-spoonfuls |

I know that all this seems very complex, but you will not have to figure out all your modifications this way, as I can show you some short cuts which will simplify matters greatly. It is very important, however, to *know how* to use this long method of calculation, even if you do not use it much. The calculation is just the same for any formula, and any desired formula may be calculated by using this one as a model. The advantage of knowing this method of calculation is that no tables whatever are necessary: all that is necessary is to remember the percentage composition of the milk and cream and the various steps used in the calculation, and when it is once learned, it is not forgotten. *I wish to emphasize particularly that not one of you can learn to figure formulæ by hearing me talk about it: you must give the matter a little thought yourselves and take a pencil and paper and figure a few.* If you are willing to give the matter an hour of your time some day, I am sure that you can all learn to calculate these formulæ very quickly and readily, and that you will find this of great value in your practice. A great many practitioners have objected to percentage feeding on the ground that the calculation of the formulæ is too complicated. It is more a question of laziness than anything else; any man can learn these methods if he is willing to take a little trouble, but he certainly never can learn them by reading this over superficially or by hearing some one else talk about them; he must do a little thinking for himself. It is often of importance to calculate backward; that is, if it is known that a certain number of ounces each of skimmed milk, gravity cream, and milk-sugar are being used, how can it be determined what percentages are being obtained? Let us say we are using this formula:

| | |
|---|---|
| Gravity cream | 8 ounces |
| Skimmed milk | 20 " |
| Water | 20 " |
| Milk-sugar | 4 tablespoons |

Total mixture equals 48 ounces.

Then:

$\frac{8}{48}$ of 16.0 = 2.6 percent fat
$\frac{28}{48}$ of 3.2 = 1.8 percent protein
$\frac{28}{48}$ of 4.5 = 2.8 percent sugar, went in with the skimmed milk and cream

Four rounded tablespoons (2 ounces) of sugar equal about 4.00
Then we have,

Fat, 2.60; sugar, 6.8; protein, 1.8.

**Short Method.**—The method of calculation which we have been discussing is of value because when it is once learned no tables are necessary. But it *is* rather long; it *is* a good deal of trouble to go to all this figuring every time a modification is prescribed, and it is usually not necessary, for there are certain short cuts which simplify matters greatly, and which enable one to figure formulæ much more quickly than is possible with the "long method." There are two simple tables which must be remembered if this short method is used, but these are not complicated and they can usually be carried in the head. I think this short method is the one you will want to *use* in feeding your babies, rather than the long one. It is as follows:

In a 16-ounce mixture the number of ounces of 16 percent (gravity) cream that is needed always equals the fat percentage desired, and the number of ounces of skimmed milk *and* cream needed always equals five times the percentage of protein desired. Thus, let us say that a mixture of 16 ounces is wanted, containing:

| | |
|---|---|
| Fat | 3 percent |
| Sugar | 6 " |
| Protein | 1.8 " |

Then—

3 ounces of gravity cream is needed
1.8 (protein percent desired) × 5 = 9 ounces skimmed milk and cream

This means 6 ounces skimmed milk, for 9 − 3 = 6.

We have put 9 ounces of skimmed milk and cream into a 16-ounce mixture: how much sugar have we put in with this?

$\frac{9}{16}$ of 4.5 percent of sugar = about 2.5 percent sugar.

We need 3.5 percent *more* sugar. How much dry milk-sugar are we going to need? This can be very easily calculated from the following sugar table, or it can be figured out by ounces, as we did in the long method.

### Sugar Table

One *level* tablespoon of sugar raises the sugar percentage—

2.40 percent in a 16-ounce mixture
2.00 percent in a 20-ounce mixture
1.60 percent in a 24-ounce mixture
1.20 percent in a 32-ounce mixture
1.00 percent in a 40-ounce mixture
.95 percent in a 42-ounce mixture
.80 percent in a 48-ounce mixture

In this 16-ounce mixture we are dealing with we have figured that we need 3.5 percent more sugar. Then, dividing 3.5 by 2.4 to get the number of tablespoons, we get $3.5 \div 2.4 = 1.4$, or about 1½ level tablespoons of sugar. Water, of course, is added up to 16 ounces.

This method of calculating simplifies the whole procedure a great deal, as you can easily see. The sugar table is easily remembered after it has been used a number of times.

In a 16-ounce mixture, you will remember, the figure to multiply the desired fat percentage by to secure the required number of ounces of cream is 1, and the number to multiply the protein percentage by to secure the number of ounces of milk *and* cream is 5. There are similar figures for different mixtures, which are as follows:

| | | |
|---|---|---|
| 20 ounces: | Fat factor, 1.25 | Protein factor, 6.2 |
| 24 ounces: | Fat factor, 1.50 | Protein factor, 7.5 |
| 32 ounces: | Fat factor, 2.00 | Protein factor, 10.0 |
| 40 ounces: | Fat factor, 2.50 | Protein factor, 12.5 |
| 42 ounces: | Fat factor, 2.60 | Protein factor, 13.1 |
| 48 ounces: | Fat factor, 3.00 | Protein factor, 15.0 |

You will see that it is a great deal easier to figure modifications by this table than to calculate them by the "long method" which I first spoke of, and if a little card is carried in the pocket with the different fat and protein factors on it, it is a simple matter to figure any modification in a very short time. The mixtures most frequently used are 16-, 32-, and 48-ounce mixtures, and it is very easy to remember, without any card, that the fat factors are 1, 2, and 3 respectively, for these mixtures, and the protein factors 5, 10, and 15.

This covers the gravity cream and skimmed milk method of milk modification.

Now let us turn to the whole milk method; that is, simple dilutions of whole or skimmed milk with water and addition of sugar. This is the method which is best to use with people who are too ignorant to handle the skimmed milk and cream method, and most normal babies will get along fairly well with it. As I have said before, its disadvantages are that the fat in the milk is usually too much reduced, and it is impossible to secure by this method certain combinations of percentages of the food elements which can be obtained by the use of the gravity cream and skimmed milk method, which might be needed in feeding certain abnormal babies. It depends a great deal upon what combination of percentages is desired whether the gravity cream and skimmed milk or the whole milk dilution method should be used, and it is simpler, if one *can* get the percentages one wants by it, to use the latter method.

Also, normal babies over eight or nine months old can be fed very well on whole milk dilutions, as what we are driving at at this period of the baby's life is to get it gradually onto whole milk—and a baby of this age needs comparatively little diluent in its milk, so the fat is not reduced too much by dilution. These are some of the considerations which should be taken into account in the choice of a method.

In using whole milk dilutions it is best not to say to oneself that one wants certain percentages in the formula, and then to calculate it out, for in many cases one will have picked out an impossible combination of fat and protein percentages. One can, of course, obtain any sugar percentage desired (provided it is not too low), whether the cream and skimmed milk or the whole milk method is used. In using whole milk dilutions either one of two procedures may be employed:

1. Use the desired amounts of milk, water, and sugar, and then calculate what the percentages are, so that the modification can be checked and the approximate composition of the mixture determined, so that the baby does not get too strong or too weak a formula. As a matter of fact, after a person has fed babies for a while this way, he knows almost automatically about what the percentages are in any dilution, and does not need to stop and calculate them. It is not accurate or at all advisable, except in the case of babies who are nearly on

whole milk, or in those who have infectious diarrhea, and who are being underfed any way, to simply mix milk, water, and sugar and pay no attention to the percentages; one is likely to get into trouble if this is done, and the percentages should always be figured as a check to this method of feeding. Let us say that a baby is being fed on whole milk and water dilution, and one wants to know what percentages it is getting. Say it is taking a 48-ounce mixture:

| | |
|---|---|
| Whole milk | 36 ounces |
| Water | 12 " |
| Milk-sugar | 4 level tablespoons |

Then, as whole milk contains:

| | |
|---|---|
| Fat | 4.0 |
| Sugar | 4.5 |
| Protein | 3.2 |

$\frac{36}{48}$ of 4.0 = 3.0 percent fat in the mixture
$\frac{36}{48}$ of 4.5 = 3.3 percent sugar in the mixture
$\frac{36}{48}$ of 3.2 = 2.4 percent protein in the mixture

A level tablespoonful of milk-sugar added to a 48-ounce mixture raises the sugar percentage 0.8 percent. Therefore the sugar percentage in this mixture has been raised 3.2 percent, which, added to the sugar that has already been put in *with* the milk (3.3 percent), gives 5.5 percent sugar in the mixture, and the baby is getting—

| | |
|---|---|
| Fat | 3.0 |
| Sugar | 5.5 |
| Protein | 2.4 |

The same method is used in figuring any whole or skimmed milk and water dilution.

2. Another way that one can use whole milk dilutions is with the aid of a table, which is perhaps easier. In any whole milk and water mixture if $\frac{5}{16}$ of the mixture is milk, that is, 5 ounces milk in a 16-ounce mixture, and the rest water, the percentages are:

| | |
|---|---|
| Fat | 1.25 |
| Sugar | 1.40 |
| Protein | 1.00 |

Similarly, if more milk is added:

| | | |
|---|---|---|
| $\frac{6}{16}$ = Fat 1.50 | Sugar 1.70 | Protein 1.20 |
| $\frac{7}{16}$ = Fat 1.75 | Sugar 2.00 | Protein 1.40 |
| $\frac{8}{16}$ = Fat 2.00 | Sugar 2.25 | Protein 1.60 |
| $\frac{9}{16}$ = Fat 2.25 | Sugar 2.50 | Protein 1.80 |
| $\frac{10}{16}$ = Fat 2.50 | Sugar 2.80 | Protein 2.00 |
| $\frac{11}{16}$ = Fat 2.75 | Sugar 3.00 | Protein 2.20 |
| $\frac{12}{16}$ = Fat 3.00 | Sugar 3.30 | Protein 2.40 |

The amount of sugar necessary to add can be determined by referring to the sugar table given above, which I will repeat again for the sake of clearness:

One *level* tablespoonful of sugar raises the sugar percentage—

2.40 in a 16-ounce mixture
2.00 in a 20-ounce mixture
1.60 in a 24-ounce mixture
1.20 in a 32-ounce mixture
1.00 in a 40-ounce mixture
.95 in a 42-ounce mixture
.80 in a 48-ounce mixture

The table of whole milk dilutions is calculated on the basis of sixteenths. Of course, if one is dealing with a 32-ounce or a 48-ounce mixture, the fraction $\frac{5}{16}$ or $\frac{6}{16}$, etc., is multiplied through by 2 or 3, as the case may be; that is, $\frac{5}{16}$ is the same as $\frac{10}{32}$ or $\frac{15}{48}$.

Proportionate calculations can be made for 24-ounce or 40-ounce formulæ, that is, in a 24-ounce mixture the amount of each ingredient would be $\frac{3}{2}$ times what it would be for a 16-ounce mixture, or in a 40-ounce mixture it would be $\frac{5}{4}$ what it would be for a 32-ounce mixture. Thus we can accurately figure from this table 16-, 24-, 32-, 40-, and 48-ounce mixtures, which are the most common ones used.

So much for the calculation of percentages. The "whole milk" method is considerably simpler to use than the gravity cream and skimmed-milk method, and it will probably be the more practical one for you gentlemen to use most of the time in feeding many of your normal babies.

Now for the calculation of the calories. There may be very accurately calculated percentages of the food elements in the mixture, but if the baby is not getting *enough* to eat, they do not do him much good. Most babies require about 50 calories per

pound of body weight in order to thrive. This varies a good deal, of course, in different babies. If a baby is gaining weight steadily and is doing well, there is not much use in calculating the calories in its food. It is self-evident that it is getting enough to eat from the simple fact that it is gaining weight. If it is not gaining, however, or if the weekly gains are too small, it is advisable to calculate the caloric value of the food, and it can be done very easily by the following simple formula:

$$(2F + P + S) \times 1\tfrac{1}{4}\,Q = \text{total calories}$$

F = The fat percentage of the food
P = The protein percentage of the food
S = The sugar percentage of the food
Q = The twenty-four-hour quantity of the food

To a man who has not been brought up in the method the use of so many figures and calculations may seem extremely complicated; but, as I have said before, the feeding of a baby who is not doing well is a very delicate task, which requires a great deal of painstaking care, and much time and thought must be given to it if good results are to be obtained. I am perfectly sure that after you have used these methods for a while you will have no trouble whatever with them.

*I wish to emphasize particularly that in using the percentage method it is not necessary to calculate the percentages too accurately, for any chain is only as strong as its weakest link, and it is nonsensical to try to get greater accuracy in the calculating than there is in the percentage of the milk to start with, or in the methods of mixing it.*

The idea of great accuracy in calculation is one that has been a stumbling-block to many beginners in percentage feeding. At the next lecture we will take up the feeding of the premature and normal baby and a discussion of the various proprietary foods.

## LECTURE III

# THE FEEDING OF NORMAL INFANTS—THE PROPRIETARY FOODS—PREMATURE INFANTS

### THE FEEDING OF NORMAL INFANTS

I am going to take up today the feeding of normal babies and children, then a discussion of the various proprietary foods, showing their advantages and disadvantages. After that, if there is time, I shall discuss the care and feeding of premature infants.

Breast milk contains 4 percent fat, 7 percent sugar, 1.6 percent protein—a food relatively rich in fat and sugar and poor in protein. It is reasonable to suppose that as this is the type of food nature intended for infants, the best artificial food for them is a food which somewhat approximates breast milk in its composition, and in which, especially, the *proportion* of one element to another is somewhat the same as it is in breast milk.

*We do not try to exactly imitate breast milk, however. Rather do we try to fit the milk to the digestive capacity of the individual baby, determining this capacity by watching the baby's symptoms, its weight, and by carefully examining its stools.*

The feeding of any baby is more or less experimental for the first few feedings. The digestive capacity of average babies of similar size, age, and weight is known; but the digestion of any particular baby is at first an unknown quantity, until the physician becomes better acquainted with it, so the baby is given a milk which it *ought* to be able to take, and if it cannot digest that, the food has to be altered to suit the capacity of its digestion. It is very important in all artificial feeding to fit the food to the baby. The baby, and not rules and tables, ought to be followed in artificial feeding. Remember the individual baby and certain broad general principles which apply to all babies.

The feeding of sick babies is a different proposition from feeding well babies. Often a sick baby cannot take a milk that is

anything like the milk a well baby would take. More than ever, dealing with these abnormal cases, does the food have to be fitted to the particular digestive and absorptive power of the individual baby.

How often is a baby to be fed, how strong a food is it to take, how much of it in the twenty-four hours, and how much at each feeding?

As I said last time, this varies a great deal for different babies. Two babies of the same age, size, and weight may take entirely different amounts and strengths of food and may need entirely different intervals. Especially is it true that two babies of the same size and weight, but of different ages, will need different foods. The older baby will need a great deal more food and stronger food than the younger baby. In general, an older baby needs more calories per pound of body weight than a younger baby of the same size and weight.

Now, if we were feeding a baby rather small amounts of food, we would naturally give these small amounts more often. If a large feeding is given each time, the intervals should be lengthened. This table shows what most well babies will take and the most usual intervals employed:

| Age | Twenty-four-hour Amount | Number of Feedings, Amount and Intervals |
|---|---|---|
| 1 wk. | 10–12 ounces | 10 feedings of 1 ounce every 2 hours |
| | | 8 " " 1½ ounces " 2½ " |
| 4 wks. | 20 " | 8 " " 2½ " " 2½ " |
| | | 7 " " 3 " " 3 " |
| 4 mos. | 32 " | 8 " " 4 " " 2½ " |
| | | 7 " " 4¼ " " 3 " |
| 6 mos. | 36–42 " | 6 " " 6–7 " " 3 " |
| 9 mos. | 48 " | 6 " " 8 " " 3 " |

(From Morse and Talbot's "Infant Feeding.")

Composition of Food

| Age | Fat | Sugar | Protein |
|---|---|---|---|
| First food | 1.00 | 5.00 | 0.50 |
| First week | 2.00 | 6.00 | 0.75 |
| 1 month | 3.00 | 7.00 | 1.20 |
| 2 months | 3.00 | 7.00 | 1.60 |
| 4 months | 3.00 | 7.00 | 1.80 |
| 6 months | 3.50 | 7.00 | 2.25 |
| 8 months | 4.00 | 7.00 | 2.50 |
| 1 year | 4.00 | 4.50 | 3.20 (whole milk) |

As to night feedings, most babies, or at least a great many babies over four or five months old, will get along without any, taking their feedings from six in the morning to nine or ten at night, and going through the night without any feeding until the next morning. In general it is a bad plan to allow the baby to take two or three night feedings unless there is some special indication. If the baby is atrophic and not doing well, of course it will probably have to be fed through the night. But it is a good plan to do away with the night feeding if possible, because it saves so much trouble to the parents, and most babies can get along without any, or if they require it at all, they can get along with one feeding instead of two or three.

Let us take up again the different elements of the food. First, let us consider the fat. It is always unwise to feed any baby, no matter how old, on more than 4 percent of fat. That is the limit of fat tolerance for practically every baby. Most babies will not be able to take even this amount. Most of them, until seven or eight months of age, will get along better on 3 percent than on 4. Some babies will get along better on 2 percent than on 3.

The fat in the milk causes more trouble than any other element. More babies have chronic nutritional disturbances from a difficulty of fat absorption than from any other cause.

It is important to consider what percent cream is being used in making up the modification if the gravity cream and skimmed-milk method is used. It is not, of course, correct to use a 32 or 20 percent cream, and calculate as though it were a 16 percent cream, because the baby may be getting in this way 6 or 7 percent of fat when the feeding is supposed to contain only 3 or 4 percent. In calculating fat percentages it is well not to give any baby over 3 percent of fat when using the gravity cream and skimmed-milk method of modification, because the skimmed milk inevitably contains a small amount of fat, and the fat percentage will be higher, in using this method, than the calculation shows.

Also, throughout this particular district of North Carolina there seem to be a great many Jersey cows, or cows of part Jersey blood. It must always be remembered that Jersey milk is richer in fat than other milks are, and for this reason, if the

milk of a Jersey cow has to be used, it is well to remove part of the cream before making up the milk modification. The milk from a mixed herd is likely to be much more uniform in composition than is the milk from one cow, and this is why it is usually best to feed a baby on milk from a mixed herd, if it can be obtained.

Some babies who cannot take milk-fat well are able to take olive oil, and in such cases it is well to give a teaspoonful of olive oil three or four times a day rather than give so much fat in the milk. Rubbing the baby with oil does not do much good, because there is practically no absorption through the skin. This merely keeps the skin in good condition and does not act as a food for the baby.

Recently there has come into use what is called homogenized milk. It is made by intimately mixing olive oil and skimmed milk by forcing them through a valve under considerable pressure. The oil-globules are broken up and made very small, and this milk is often much better digested than any other in certain cases of chronic fat indigestion, where the baby cannot take the milk-fat. I am sure this milk will be available to everybody in a few years, but it is not at present, so this, for you gentlemen, now is a matter of theoretical interest rather than of practical importance.

Let us consider next the sugar. There are a number of different sorts of sugar. There are lactose, or milk-sugar; sucrose, or cane-sugar; and maltose, or malt-sugar. These are the three sugars used in practical infant feeding. Ordinary lactose, or milk-sugar, is the best for feeding most normal babies. It may be split up in the intestine into acids, and when it ferments, is likely to be rather laxative. Sucrose has ordinarily no advantage over lactose except that it is cheaper. Generally it is better not to feed babies on sucrose if one of the other sugars is available.

Maltose is never given pure. Pure malt-sugar is very expensive and hard to obtain. Malt-sugars and the various malted foods consist of part dextrins and part malt-sugar. Some of these preparations which we must consider are as follows:

| | Composition Maltose | Dextrins |
|---|---|---|
| Meade's Dextri-maltose....... | 51 percent | 47 percent |
| Mellin's Food................ | 58 " | 20 " |
| Maltine Malt Soup .......... | 62 " | 3 " |
| Loeflund's Malt Soup Extract.. | 59 " | 15 " |

Maltose is more readily absorbed than lactose, and its assimilation limit is higher; that is, a baby can take more maltose without showing sugar in the urine than it can lactose or sucrose. Malt-sugar ferments less readily than does lactose, and for this reason a malt-sugar preparation is often of value in feeding certain cases of sugar indigestion or fermentative diarrhea. Malt-sugar is also ordinarily the best sugar to use in feeding cases of convalescent infectious diarrhea. All the malt-sugar preparations consist of combinations of maltose and dextrins. If the proportion of maltose is high in comparison with the dextrins, the food is likely to be laxative; if the proportion of dextrins is relatively high, it is likely to be constipating. Dextri-maltose, on account of its high content of dextrins, is somewhat constipating; the other malt-sugar preparations are laxative. The various malt-sugar preparations are of unquestionable value in feeding certain cases; but two things must be remembered about them:

1. Some babies may have an idiosyncrasy to maltose and not be able to take it at all well, so it is by no means a universal panacea for all sugar troubles, as a good many people seem to think.

2. *It is to be distinctly remembered that none of the malt-sugar preparations or "malted foods" are complete foods, and that their proper rôle in infant feeding is simply as sugars, as substitutes for lactose—when substitution of a malt-sugar is indicated.*

Now let us take up *starch*. It has been proved a good many times that new-born babies can digest starch, but they should not ordinarily be fed this, because in practical use starch in any considerable quantity does not agree with them. I always start giving barley water in the milk when the baby is about six or seven months old. It furnishes a little extra nourishment, it teaches the baby how to digest starch, and aids in the digestion of milk casein by tending to prevent the formation of large curds. Any one of the ordinary barley flour preparations on the market

may be used. A tablespoonful to a pint of water gives a 1.5 percent suspension of starch. The best amount to use is ordinarily about 0.75 percent starch in the milk mixture, as it has been found that this is the optimum amount to prevent the formation of large casein curds.

"Barley jelly" is of very great value in infant feeding; it consists merely of a thick barley gruel, and may be prepared as follows:

Add four tablespoonfuls of barley flour to a pint of water; cook in a double boiler one hour, strain to get rid of lumps; add enough water to make up to a pint again, salt to taste, and set on ice. The resulting product is a very thick gruel, and is fed to babies eleven or twelve months old. It is especially of use as the first semisolid food after infectious diarrhea.

"Oatmeal jelly" is also of considerable value, especially in feeding constipated babies over a year old. It is prepared as follows:

Oatmeal, 4 ounces; water, 1 pint. Boil four hours in a double boiler. Add water to form a thin paste. Force through a colander while still hot to get rid of coarse particles, and salt to taste.

The protein in the milk is very important because it is a tissue builder. It keeps the baby's body in a state of nitrogenous equilibrium, and every baby has to have it to keep well. The chief trouble with the protein in cow's milk is that it forms large curds in the stomach which are hard to digest. Generally the protein in the milk causes very little trouble, as it is always easy to modify it in such a way that no tough curds will be formed in the stomach.

One way to do this is to give whey mixtures instead of casein mixtures. Whey has this composition:

| | | |
|---|---|---|
| Fat 0.0 percent | Sugar 4.5 percent | Protein 0.9 percent |

and all the protein is in the form of "whey" protein, which is very easily digested and is not coagulated in the stomach. So if a baby vomits and does not digest fat and protein well, whey may be used, and most babies can easily digest it. A good many babies are able to take whey when they cannot take anything else; but it should be remembered that whey is a very weak

food and furnishes little nourishment to the baby, so is of value only as a temporary and not as a permanent food. If it is desired to increase the food value of whey, fat may be added to it in the form of 16 percent cream.

Whey is prepared as follows: To one pint of lukewarm milk add two teaspoons of Fairchild's essence of pepsin; stir and mix. Let it stand until the milk has "jellied," and then beat it with a fork to separate the curd into fine particles. Strain—best through cheese-cloth. The liquid which comes through is the whey. One quart of milk furnishes about 24 ounces of whey.

Some of the other methods for preventing the formation of large curds are as follows:

1. Addition of cereal diluents.
2. Boiling.
3. Peptonization.
4. Addition of alkalis.

1. The addition of a cooked starch preparation, such as barley water, to a milk modification, tends to prevent the formation of large tough curds in the stomach. About 0.75 percent of starch in a mixture is enough to give this action.

2. Boiling vigorously for five or six minutes produces certain chemical changes, which to a considerable extent prevent coagulation.

3. Peptonization of milk prevents the formation of a curd in the stomach, and also, to a certain extent, predigests the milk. Milk should always be peptonized when being fed by rectum, but usually it is not necessary to peptonize milk for ordinary feeding, because there are so many easier ways of preventing curd formation.

4. The addition of an alkali, in sufficient amount, to the milk prevents curd formation. The alkalis which may be used are:

Lime-water.
Sodium citrate.
Sodium bicarbonate.

For practical purposes lime-water is the best alkali to use, although there is certain evidence to show that the use of lime-water interferes somewhat with fat absorption, and in cases where the fat assimilation is poor, it should probably not be given.

Lime-water must be given in a strength of from 25 to 50 percent of the milk or milk and cream used in the mixture, if it is to have any appreciable effect. The giving of small amounts of lime-water does no good.

Sodium citrate is a valuable alkali to use to prevent curd formation. Two grains of the citrate to one ounce of milk, or milk and cream, is the amount ordinarily used.

Sodium bicarbonate is used in the same strength as sodium citrate, but has this disadvantage: it tends to upset the baby's stomach and may cause it to vomit.

I want to speak briefly of "Eiweiss," or protein milk, of which you have all probably heard. The Germans devised this milk a few years ago, in order to get a milk with a relatively high protein and low fat and sugar content for use in fermentative diarrhea. It works very well. The great trouble is that it is hard to prepare, as you will see from the directions given below, and many people cannot do it satisfactorily.

One quart of whole milk is heated to 100° F. Add four tablespoons of essence of pepsin, and stir. Let it stand at 100° F. until a curd has formed, and strain off the whey from the curd. Press the curd through a fine sieve three or four times. Add one pint of water to the curd and one pint of buttermilk to this mixture.

For all practical purposes it consists then of a pint of buttermilk, a pint of water, and curd from a quart of milk. It contains about 2.5 percent fat, 1.5 percent sugar, 3 percent protein. It can be used if one is dealing with an intelligent family who will take the trouble to make it.

If the baby does not take fat well, it is best to skim the milk used in making the curd.

There is a product on the market called Larosan which is a good deal easier to use than this Eiweiss milk. It is in the form of a powder, which can be added to a milk mixture to give a high protein percentage. It is a practical thing to use, and a great many babies with fermentative diarrhea will do extremely well on it. The trouble is that the war has interfered with its production, and it is now extremely hard to get.

Let us consider buttermilk for a moment. It has about this composition: 1 to 0.5 percent fat, about 3 percent sugar, and

about 2.5 percent protein. The protein is in a precipitated form, which cannot be coagulated again in the stomach, and there is a very low sugar percentage. There is also lactic acid, which tends to prevent fermentation or putrefaction. These are the advantageous points of buttermilk. Lactic acid bacillus or "bulgaricus" *cultures* are of great value in preparing lactic acid milk. I am somewhat skeptical, however, about many of the *tablets* which are put on the market, and do not believe they are as efficient as the liquid cultures or as ordinary buttermilk. Buttermilk is often of very great value in feeding babies. The trouble with it is that it is hard to tell whether or not it is good buttermilk. It may be full of all sorts or other bacteria besides the lactic acid bacteria. If liquid cultures are used, however, and one makes one's own lactic acid milk, one can be sure of getting a clean preparation.

## PROPRIETARY FOODS

The proprietary foods have certain good points and a great many bad points. Of course, in certain districts where cow's milk cannot be obtained the proprietary foods have to be used; but in general the indiscriminate use of proprietary foods has done more harm than good, because they are usually prescribed without any knowledge whatever of their composition. Most of them are of such composition that they do not give a baby a well-balanced ration, and may be of value to add to a milk modification, *but not to use as a complete food.* The great trouble with most of the proprietary foods is that their sugar content is far too high in proportion to the fat and protein content. Most babies fed exclusively on condensed milk or on one of the proprietary foods for any length of time get into trouble sooner or later. Proprietary foods cannot contain anything that milk cannot contain, and if one knows how to modify milk, anything can be put into it that is in any proprietary food.

I do not mean to give the impression that proprietary foods should never be used, for this is not so; but I *do* mean that if they are to be used their composition must be known in order to know the amount of each food element the baby is taking, and to be sure that it is getting a well-balanced ration. In most of

the proprietary foods the vitamins are destroyed: these vitamins are necessary for the baby's proper development. This is another reason why it is wrong to feed a baby exclusively on condensed milk or any other proprietary food for any length of time.

For many years many people have tried to produce a universal infant food which will be a perfect substitute for breast milk and which can be fed to any baby. Such a food will never be produced; what is food for one baby may be poison for another, and any artificial food must always be fitted to the digestive capacity of the individual infant. There is no such thing as a universal infant food upon which all babies can be fed, except breast milk, and there never will be.

If proprietary foods are used, their composition should be known. There are five classes of proprietary foods, which may be roughly divided as follows:

1. Condensed milks and evaporated milks.
2. Malted foods.
3. Malted foods containing starch.
4 Starchy foods, containing practically nothing but starch.
5. The various "dry milk" powders.

In class 1 belong the ordinary sweetened, thick condensed milks and unsweetened evaporated milks. To the second class belong Mellin's Food, Horlick's Malted Milk, etc. (Horlick's Malted Milk is not exactly like Mellin's Food in composition, as its basis is a dried milk preparation to which considerable maltose and dextrins have been added; but in practical use it may be considered to be much the same sort of preparation as Mellin's Food.) In class 3 is Eskay's Food; in class 4, Ridge's Food and Imperial Granum, and in class 5 "Kindolac" is a fair representative of the group.

The condensed milks have all practically the same percentage composition. The average composition is about as follows:

| | | |
|---|---|---|
| Fat 9 percent | Sugar 55 percent | Protein 8 percent |

This is a very poorly balanced ration, because there is too much sugar for the fat and protein. When the sugar is reduced by dilution with water to the proper percentage, the fat and the protein are reduced too much, and the baby does not get enough

to eat. One part of condensed milk and two parts of water give these percentages:

Fat 3 percent    Sugar 18 percent    Protein 2.6 percent

The fat and the protein would be about right in this mixture for some babies, but few babies can take 18 percent of sugar for any length of time without getting into trouble. If the condensed milk is diluted with four parts of water, this percentage results:

Fat 1.8 percent    Sugar 11 percent    Protein 1.6 percent

Condensed milk is usually diluted more, and the dilution I have generally seen used is one part of condensed milk to six parts of water. That would give a very weak mixture, with little nourishment for the baby. With eight parts of water the fat would be 1, sugar 6, and protein 0.9. The reason why condensed milk is so much in favor is that a great many babies who have been fed on too strong or improperly modified cow's milk can take diluted condensed milk simply because it *is* so dilute that it is no tax to their digestions. Still they are not getting enough to eat. I have noticed that there is an opinion prevalent among many of the laity here that cow's milk is impossible for many babies to take, especially in the summer, and that condensed milk is the thing always to give them if they become upset on cow's milk. Of course this is absolutely fallacious; there *are* certain rare cases in which a baby shows an idiosyncrasy to cow's milk and can never take it without disturbance, but these cases are very, very uncommon, and almost always when a mother says "the baby cannot take cow's milk" it is simply because the milk has not been modified properly to suit the baby's digestion. If cow's milk is modified properly and is reasonably clean, most babies can take it as well as they can condensed milk or any other proprietary food. Condensed milk may be of value occasionally to tide a baby over for a few days when a very weak food is desired, *but it is absolutely unsuitable as a food for any baby whatever over long periods of time.*

The unsweetened evaporated milks have a better composition than the condensed milks. The percentage composition of most of them is this:

Fat 9 percent    Sugar 10 percent    Protein 7 percent

One part of evaporated milk to three of water gives this percentage:

| | | |
|---|---|---|
| Fat 2.25 percent | Sugar 2.5 percent | Protein 1.7 percent |

A 1 to 4 dilution gives:

| | | |
|---|---|---|
| Fat 1.8 percent | Sugar 2 percent | Protein 1.4 percent |

Milk- or malt-sugar should be added to evaporated milk dilutions to bring up the sugar percentage. These evaporated milks are much better to use than condensed milks, and are the preparations to be used if fresh cow's milk cannot be obtained.

Horlick's Malted Milk has this composition:

| | | |
|---|---|---|
| Fat 9 percent | Sugar 67 percent | Protein 16 percent |

Its basis is dried milk, to which maltose and dextrins have been added. Mellin's Food contains:

| | | |
|---|---|---|
| Fat 0.16 percent | Sugar 80 percent | Protein 10 percent |

These foods are occasionally valuable in infant feeding to use as sugars to correct constipation, as the malt-sugar which they contain is mildly laxative. It must be remembered that *they are not complete foods,* and should not be used as such; whatever value they have is in their content of maltose and dextrins.

The third class of foods contain a certain amount of starch in addition to the other constituents. Eskay's Food is an example of this group, and contains

| | | | |
|---|---|---|---|
| Fat 3.5 percent | Sugar 55 percent | Starch 29 percent | Protein 6.7 percent |

It is valueless unless used simply as a sugar or starch would be used, as an addition to fresh cow's milk, because when it is diluted with water the baby gets practically nothing but carbohydrates.

Imperial Granum, which belongs to the fourth class, consists mostly of starch, part of which has been dextrinized. It may be used in the same way that barley flour preparations are used.

"Kindolac" is a "dried" milk, belonging to the fifth class. Its composition is:

| | | |
|---|---|---|
| Fat 13 percent | Sugar 61 percent | Protein 19 percent |

Generally speaking, the trouble with most of the dried milk preparations is that they do not contain enough fat, as a high fat content interferes with the drying process. So much for a few of the proprietary foods. As a brief general summary it is fair to say this:

*Most of the proprietary foods do not contain a suitable balance of the several food elements to allow them to be used as complete foods for any baby; the carbohydrate content is usually high—out of all proportion to the fat and sugar. If they are used at all, they should be used as substitutes for sugar in the modification of fresh milk. It is necessary always in using any proprietary food to know approximately its composition.*

When can a baby take solid food? As the first solid food that it usually takes is cereal or bread, it is well to add barley water to the milk of most babies when they are six or seven months old in order to have them get used to starch. When the baby is nine months old, it can have a piece of dry toasted bread or zwieback to hold in its hand and chew on occasionally. When it is ten months old, give it a couple of tablespoonfuls of barley jelly or of farina during the day. At a year old the baby should be put on four-hourly feeding intervals, at 7, 11, 2, and 6, and the twenty-four-hourly quantity of milk should be limited to a quart. *It is a great mistake to give a baby who is over a year old too much milk; at this period of its development it is beginning to need solid food, and if too much milk is given, the appetite for solid food is likely to be lost.* Most babies of eleven or twelve months can take whole milk undiluted, and in addition farina or barley or oatmeal jelly and zwieback. Chicken or mutton soup (with the fat removed), beef-juice, and prune-juice or orange-juice may also be given. At about sixteen months most babies can begin to take eggs and potatoes. The egg should be soft boiled or coddled, and not more than a teaspoonful should be given at first, as sometimes eggs cause severe upsets in small babies when they first start to take them. *It is a bad mistake to feed eggs to most babies under fifteen or sixteen months.* If the

baby seems to be able to take the egg well, the amount can be gradually increased until it is taking one egg every other day. Potato is best given as mashed potato, and this should be *well* mashed, with a good deal of milk added, so that there are no large lumps, which almost always go through the baby undigested. At two years of age a baby can be given finely chopped meat: lean beef, chicken, and mutton are the best meats to use. At about this same time green vegetables may be given, but it is very important to remember that these must be thoroughly cooked and mashed or well chopped, so that the indigestible cellulose portion will not irritate the baby's intestine. Peas, beans, stewed carrots or celery, and asparagus-tips may be given in this way.

As to fruit, I must write it in italics: *Green fruit of any sort should not be given to any child whatsoever under four years of age.* There certainly are some babies who seem to be able to eat anything and not be upset by it, but for most babies green fruit or green vegetables, improperly prepared, are absolutely contraindicated.

Even after four years of age, and well along into childhood, the use of fruits should be considerably restricted, and if they are eaten, special care should be taken that no skins, rinds, or cores are swallowed. Of course, at about two years a child may take a moderate amount of properly prepared *stewed* fruit, such as prunes, peaches, or apricots. *Never* give any child a whole orange; the *juice* of the orange is good for him, the rest of it is not. Small amounts of ripe raw scraped apple are also good for some babies as an antiscorbutic when orange-juice cannot be obtained.

The diet list of the Children's Hospital, Boston, for babies of about eighteen months, is as follows:

| | | |
|---|---|---|
| Milk | Milk-toast | Baked potato |
| Butter | Zwieback | Plain macaroni |
| Mutton broth | Plain crackers | Orange-juice |
| Chicken broth | Barley jelly | Baked apples |
| Beef-juice | Oatmeal jelly | Stewed prunes |
| Soft-boiled eggs | Cream of Wheat | Baked custard |
| Dropped eggs | Farina | Corn-starch pudding |
| Toasted bread | Rice | Blanc-mange |

The following diets are taken from that splendid little book of Dr. Richard Smith's, "The Baby's First Two Years":

*Diet at Thirteen or Fourteen Months*

6.30–7.00: Strained cereal or gruel, 2 or 3 ounces
Milk, 8 ounces
8.30: Orange-juice
10.00–10.30: Milk, 8 ounces
2 zwieback or plain cracker
1.30–2.00: Broth or beef-juice
Rice or macaroni or spaghetti
Bread or toast or cracker
Milk, 4 to 5 ounces
5.30: Milk, 8 ounces
Cereal or gruel
Apple-sauce or prune-juice

*Diet at Sixteen to Eighteen Months*

7.00: Cereal
Bread and butter
Milk, 8 ounces
8.30: Orange-juice
10.00–10.30: Milk, 8 ounces
Cracker or toast
1.30: Egg or beef-juice or scraped beef or minced chicken
Potato or rice or macaroni or spaghetti
Bread and butter
Simple dessert (custard, junket, tapioca)
Milk, 4 or 5 ounces

*Diet at Twenty to Twenty-two Months*

6.30–7.00: Orange-juice
7.00–7.30: Cereal
Egg
Bread and butter
Milk
10.30: Milk
Cracker or bread
1.30: Meat
Potato
Green vegetable (purée)
Bread and butter
Simple dessert
5.30: Cereal
Milk
Bread and butter *
Fruit-sauce

* Bread at least two days old; butter spread very thin.—L. W. H.

## PREMATURE BABIES

Now I want to talk for a little while about premature babies. Two things have to be remembered in dealing with premature babies: first, that a premature baby must be kept warm, and secondly, its digestion is extraordinarily feeble, so it must be given very weak milk mixtures.

Incubators were formerly thought to be of great value in the care of premature babies, but have now been discarded by most pediatricians. A small crib, with padded sides to prevent drafts, is the best place in which to keep a premature baby. There should be a thermometer kept in this crib, and the temperature should be between 90° and 95° F.; the rectal temperature should be taken two or three times a day to be sure that the baby's body-heat is kept up. If the rectal temperature varies between 98° and 100° F., there is no cause for any change in the heating arrangements. A premature baby should not be washed with water, but should be oiled with warm olive oil and wrapped in cotton wool or a gown made of cotton wool between two layers of very soft cheese-cloth. It is well not to use any diapers on a premature baby, but to put a pad of cotton wool between its legs, and simply change it when it is dirtied. The reason for this is that premature babies bear handling very poorly; the less they are handled, the better off they are. Don't weigh the baby often—it bothers it too much; once a week is enough. Premature babies seem to get along better if their air supply is moist, so it is of advantage to keep a little alcohol or electric lamp going in the room, with a shallow vessel of water over it, to secure the necessary moisture. The temperature of the room should be about 80° F. A premature baby needs reasonably clean air as much as anybody else does, so be sure that the room is properly ventilated and not kept hermetically sealed to fresh air all the time.

*Get breast milk, if possible, for a premature baby.* In most cases, of course, it must be obtained from some woman other than the mother. If the baby is born at six or seven months, the mother probably will not have enough milk, but if the baby is born nearly at full term, perhaps she will have. Give the premature baby very weak food at first. It can scarcely be too

weak to start with. The food on which a premature baby should be started is breast milk, one-half, and a 3 percent sugar solution, one-half. Give a dram at a feeding every two hours for the first twenty-four hours of the baby's life, and start feeding when it is twelve hours old. The stomach of a baby born at term holds about one ounce, therefore the capacity of the stomach of a premature baby can be judged. If the baby is doing well, taking its food well, and if it seems hungry, the amount can gradually be increased. Most premature babies, if they are doing well, can take undiluted breast milk when from a week to ten days old.

Of course a dram at a feeding of such a weak mixture as we have spoken of is not enough to cover the caloric needs of the baby; but premature babies do not have digestions which correspond with their theoretical caloric needs, and this is the difficulty. One of these babies must be fed what it can take, and not what it ought to have to get fat on.

The dram feedings may be necessary only for the first few feedings, after which the amount may be increased. The amount should be increased before the strength of the food is increased.

If a premature baby is born nearly at term, it is possible that it will be able to take the breast, but most of them are too weak to suckle satisfactorily; so it is usually necessary to pump the breast milk and to feed it with a Breck feeder or a large medicine-dropper. A Breck feeder is nothing but a big medicine-dropper which has a fancy name and costs a dollar and a quarter.

The use of a medicine-dropper applies equally to premature babies who are fed on modified cow's milk, as well as to those who are taking breast milk.

It lessens the chances of survival for a premature baby if it has to be fed on cow's milk, but in many cases this has to be done.

The best percentage to start with is—

Fat 1 percent    Sugar 4 percent    Protein 0.5 percent

or it can be started on one-half whey and one-half 4 percent sugar solution, adding a small amount of 16 percent cream to give a little fat as the baby gets older.

If premature babies have trouble with their digestions,—vomiting or loose bowels,—they should not be starved or given a cathartic, as they do not stand either of these procedures at all well. The treatment of indigestion in prematures is to cut down the strength or amount of the food or to lengthen the intervals of feeding. It is especially important to guard the premature baby against infections of any sort; what might not hurt another baby, such as a slight cold in the head or a mild bronchitis, might prove fatal to a premature.

Prematures need a good deal of water inside, but none outside. The water should be given between each feeding, the amount being the same amount as the feeding.

What is the prognosis for premature babies? These three facts were brought out from an analysis of 125 cases by Dr. Maynard Ladd: The mortality was 65 percent in babies weighing under four and one-half pounds at birth. A baby under this weight is very likely to die. Second, no child weighing less than two and one-half pounds lived. Third, no child at the sixth month of gestation lived.

A premature baby needs an extreme amount of painstaking care. Nothing in the world is harder to take care of, both as to its feeding and as to its general care.

## LECTURE IV

# DIFFICULT FEEDING CASES—THE VARIOUS TYPES OF INDIGESTION—THE STOOLS IN INFANCY—CONSTIPATION

I am going to talk today about the feeding of abnormal babies and the different types of indigestion and of nutritional disturbances.

There is no absolutely satisfactory classification of digestive disturbances; the classification which I am going to give you has its faults, but it is, in the main, fairly satisfactory. The basis of it is this: *We look upon the baby's food as being composed of elements, of which we have already spoken many times, and we look upon the disturbances of digestion and nutrition as being for the most part due to an excess or deficit in the food of one or more of the food elements, or faulty digestion or absorption of one or more of these elements, when they may perhaps be present in normal amounts in the food. The food as a whole, of course, has also to be considered, as does the proper relationship of the food elements to each other; that is, the baby must have a well-balanced food, and one element must not be present in it in great excess, as compared to the others.*

The classification is as follows:

1. Too little food—starvation.
2. Disturbances of digestion.
   - *a.* Too much food as a whole.
   - *b.* Fat indigestion.
   - *c.* Sugar indigestion.
   - *d.* Protein indigestion.
   - *e.* Starch indigestion.

**Too Little Food, or Starvation.**—First of all, let us take up class 1. There are a great many babies who have not had *enough* to eat, and that is the cause of their troubles. Some of

these babies, if the starvation has continued long enough, may present the typical picture of the so-called "marasmus" or "infantile atrophy." These are likely to be babies who have been fed on condensed milk or on one of the proprietary foods, or on milk diluted too much, and have been shifted about from one food to another—never doing well on any of them. In consequence, the baby is starved; its digestion is also extremely weak. This is a common type of case. In such cases first examine the baby carefully to exclude wasting diseases, like tuberculosis and syphilis, in order to make sure that the baby is suffering from malnutrition alone. One should always be suspicious of tuberculosis or syphilis in small, poorly nourished babies. Go into the previous feeding history carefully, and see what the child is taking at the present time and how much it is getting in calories. If the calories taken are below par, give more to eat. That is easy to say, but hard to do, because any baby fed for a long time on an insufficient amount of food has a very weak digestion, and it is necessary to start with a weak food and gradually increase it in dealing with these babies. The fat percentage especially must be raised slowly in feeding babies of this type, because they usually have very poor digestions for fat. Sometimes small doses of nux vomica are of value in these cases, but aside from this, drugs are of little aid. The stools should be examined to be sure that there is no indigestion of any particular food element in addition to the starvation. I will speak of the technic later. The examination of the stools is not the whole story in infant feeding, by any means, but it *is* extremely important and desirable to make frequent examinations of the stools of any baby who is not gaining properly in order to find out how well the different food elements are being absorbed. This is one of the fundamentals of the Boston methods of infant feeding: *In order to feed any baby intelligently the physician must regulate the food supply by the waste,—that is, the unabsorbed portion of the food,—and the food must be of such a nature that there is not too much waste. Find out by careful stool examination what element or elements of the food the baby is not digesting or absorbing, and then regulate the food supply in accordance with this.*

Let us consider now the disturbances of digestion.

## DISTURBANCES OF DIGESTION

**Too Much Food.**—A great many babies may be getting too much at a feeding or may be fed too often, or the food may be too rich. As a consequence, the digestion is upset. This type of disturbance may be acute or chronic, and is manifested by failure to gain, fussiness, colic, vomiting, and possibly by diarrhea. These cases are usually not difficult to deal with. It is generally wise to clean out the baby at once with castor oil or calomel, then starve it for twenty-four hours on weak barley water or water. Start in then with a weak food and gradually build it up to the limit of the baby's digestion, watching the stools carefully to see that this limit is not exceeded.

**Acute Fat Indigestion.**—The symptoms of acute fat indigestion from too much fat in the food are very much the same as the symptoms from too much food. The vomitus may be creamy, and the stools are likely to show a great many small white fat curds, or they may rarely be oily. First examine the stools to be sure that it is an upset from fat, and inquire into the diet. If a large excess of fat is found in the stools, cut down the fat in the diet, or cut it out entirely for a few days, feeding the baby on some modification of skimmed milk without any fat, and increasing the fat one-half percent at a time until the point is reached where the baby is getting enough fat and not too much.

**Chronic Fat Indigestion.**—Babies have more trouble from chronic *fat* indigestion than from any other form of chronic indigestion. It is really not fat *indigestion,* because the fat is split into glycerin and fatty acids perfectly, in most cases, but the soaps which are formed are not *absorbed.* The difficulty is thus in the proper absorption of the fat after it has been digested. Clinically, chronic fat indigestion is likely to be seen in babies who have been fed on high percentages of fat for a long period of time, or in babies who have been fed on foods containing a large amount of carbohydrate and very little fat—especially the proprietary foods. The exact etiology and the chemistry of the condition are rather obscure. It is known that cow's milk contains a much higher percentage of volatile fatty acids than human milk does, and also a much higher percentage of calcium,

which combines in the intestine with these volatile fatty acids to form insoluble calcium soaps which cannot be absorbed. I believe that many cases of fat indigestion are due to this, and this is why so many babies with fat indigestion will do well on breast milk, which may contain actually two or three times as much fat as the cow's milk modification which they have been unable to handle.

The symptoms of fat indigestion are that a baby does not gain in weight, is fussy and miserable, may have rickets, may vomit a little, and may have diarrhea or chronic constipation or an alternation of the two. There may be the so-called "soap" stools: hard, light colored, crumbly, consisting of insoluble soaps. The stools may again resemble scrambled eggs, with many small curds, or they may occasionally *look* normal, but show a large excess of fat none the less. The way to diagnose a fat intolerance is to examine the stools microscopically and see if there is an excess of fat present. The treatment is difficult; these are the hardest cases that one has to deal with in infant feeding. Some of them may present the picture of "marasmus."

For purposes of treatment the cases of fat intolerance may be divided into two groups:

1. *The Type With Dry, Constipated, "Soapy" Stools.*—In this type the stools are as above described, and are usually neutral or mildly acid or alkaline in reaction. The treatment is to cut the fat entirely out of the diet for a while, and make up for this by adding more sugar and protein. Care must be taken, however, not to add enough sugar or protein to give the baby a sugar or protein indigestion. This type of case usually does well on a high sugar diet, however. After a few days of a fat-free diet fat can gradually be added to the diet again up to the limit of the baby's tolerance, watching the stools carefully for fat to determine what this tolerance is. Usually it is well not to increase the fat in the diet more than one-half percent at a time. Sometimes these babies have to be kept on a low fat percentage for a long, long time, and the condition requires extreme patience on the part of both mother and doctor. It is not a question of a few days or a few weeks, but a question of months during which the baby's diet must be regulated with the

utmost care. Sometimes it is valuable to add two or three teaspoonfuls of olive oil a day to the baby's diet, as some of these babies are able to absorb a vegetable fat when they cannot absorb the fat in cow's milk. The method of homogenization of olive oil and other vegetable fats with skimmed milk is also of value in treating these cases, but, of course, is not applicable outside of two or three large cities where the homogenized milk may be obtained. *I believe it is a mistake to add any lime-water to a mixture fed to a baby with fat intolerance, as this favors the formation of insoluble calcium soaps.* If an alkali is to be used in these cases, sodium citrate is the one to use. I nearly forgot to mention one of the most important points: It is always well to get a wet-nurse, if possible, for a baby with severe chronic indigestion, whether it be of fat or of any one of the other food elements.

2. *The Type With "Scrambled-egg" Stools.*—In this type of chronic fat indigestion the stools are loose, rather frequent, and yellow or yellowish green in color. They contain many small white fat curds, *smell acid, and are strongly acid in reaction.* Microscopically they show a large excess of fat. The trouble in these cases is due to a combination of fat and of sugar indigestion, and sometimes it is hard to tell which predominates. What happens chemically is this: the fats and the sugars both break down to form volatile fatty acids, and these are present in the stools, partly free and partly combined with alkali to form soaps. It is uncertain which of these processes is primary—the breaking down of the fat or of the sugar. The absorption of the fat is hindered in a number of ways in these cases.

Insoluble soaps are formed from the volatile fatty acids and calcium present in the milk to start with, and also from the higher volatile fatty acids which have been formed in the intestine.

The reaction of the intestine is very strongly acid, due to the various acids present from abnormal fat and sugar decomposition. Bile is a very unstable substance, especially in an acid medium. It may be possible that the bile is decomposed in the strongly acid intestine, and is thus rendered useless in the emulsification of the fats which is necessary for their proper absorption.

It is a chemical fact that it is impossible for a good emulsion to be formed in a strongly acid medium. It is possible then that the proper emulsification of the fats is hindered in this way also.

This condition has always been an extremely interesting one to me, and I must confess that in very many cases it is extremely difficult and sometimes impossible to tell just how much of the trouble is due to fat and how much to sugar. I call the condition a *fat* indigestion, however, because the most striking thing about it is the poor fat absorption. The treatment must be somewhat different from that of the other type of fat tolerance, because here there is, in addition to the low fat tolerance, a low sugar tolerance. *We must, therefore, feed a food low in fat and sugar, and high in protein.* In the severe cases it is well to cut the fat entirely from the diet; in the milder cases it can be halved. The sugar should be considerably reduced, usually to 3 or 4 percent for a while, and then increased again up to the limit of tolerance as the baby improves. The protein should be as high as the baby will stand. Usually 3 percent of protein will be handled fairly well by most babies over two or three months old when they have this type of indigestion. There are two reasons for feeding a high protein percentage: first, because the digestion for protein is usually good; second, because the digestion for fat and sugar will be improved if the reaction of the intestinal contents can be made less acid, which is what happens when a high protein milk is fed.

The protein must be given in such a form that it can be easily handled. If an ordinary milk mixture is used, it is well to add two grains of sodium citrate for each ounce of milk to prevent the formation of tough casein curds in the stomach.

"Eiweiss" milk is valuable in treating some of these cases, and if this is used, the protein is, of course, in a finely divided precipitated form which is easily digested.

I have never been satisfied with the treatment of fat intolerance: we really know so little about its exact chemistry and etiology. There are so many obscure factors that enter into it, concerning which the state of our knowledge is at present so imperfect, that our results are by no means as good as they might be.

**Acute Sugar Indigestion.**—Most babies will get into trouble if they are taking over 7 percent of sugar in the diet. The

symptoms of sugar indigestion are vomiting of rather thin, sour material, a good deal of colic and gas, and the passage of frequent, loose, green, acid-smelling movements. These movements, and the whole disturbance, are due to fermentation of sugar in the intestine, with the consequent formation of volatile acids, such as acetic and butyric, irritating the intestine and thus causing increased peristalsis. Sugar indigestion is likely to be more severe than any of the other forms of acute indigestion. Most of the cases will do fairly well with proper treatment, which is to starve the baby for twenty-four hours, starting the subsequent feeding with a food very low in sugar. No castor oil is necessary, for the baby has cleaned itself out by the diarrhea it is having. After the starvation, go back to a diet with as little sugar in it as possible. "Eiweiss" milk fulfils these indications. It is always best to keep the sugar percentage low for a few days, and then very gradually add the sugar again, The sugar which is usually best to use in a case of this type is a malt-sugar preparation, because the malt-sugars have less tendency to ferment than lactose or sucrose, and are absorbed more quickly.

There are no hard-and-fast lines to be drawn between sugar indigestion and what I call fermentative diarrhea, because in most cases of sugar indigestion there is likely to be a good deal of fermentation. We shall discuss this fermentative diarrhea at the next lecture.

**Chronic Sugar Indigestion.**—Chronic sugar indigestion is not so common as chronic fat indigestion. The symptoms are very much the same as in acute sugar indigestion: the passage of loose, watery, green, acid-smelling stools. The baby's buttocks are likely to be red and irritated from the acids in these stools. When stools of this type are present, it is certain that there is fermentation of sugar in the intestine, and the indications are to feed a low sugar percentage. These cases are not so chronic as the fat cases. Generally, after giving a low sugar percentage for a few weeks, in combination with a high protein, the sugar tolerance will be so increased that a reasonable sugar percentage can be given again.

**Acute Protein Indigestion.**—Acute indigestion from protein is common. It shows itself by the vomiting of large, tough curds,

due to coagulation of the casein in the stomach. Besides this, there is likely to be a good deal of colic and abdominal pain, with or without diarrhea. There are very likely to be hard, large curds of casein in the stools. The stools may be of two sorts—yellowish or brownish, with these large curds; or of a brown color, loose, with a strongly musty, foul smell, with no curds. The treatment of protein indigestion is to cut down the protein in the milk. Usually in the type where the stools are yellow, with the curds present, this is sufficient to cure the trouble—to starve the baby for twenty-four hours and cut down the protein in the subsequent diet. In the other type the condition is a good deal more serious, and it is usually best to starve the baby a little longer, giving it a lactose solution of 6 or 7 percent with starch to 0.75 or 1 percent. In the subsequent feeding the sugar in the diet should be kept relatively considerably higher than the protein, as there is alkaline decomposition going on in the intestine and it is desirable to change the reaction of the intestine from alkaline to acid. This is usually the worst type. If tough curds are being vomited or passed in the stools, some of the methods which I have mentioned before of making the protein easily digested in the stomach may be used. This condition of protein indigestion usually clears up very well. Most babies will get over it in a few days with the proper treatment.

**Chronic Protein Indigestion.**—Chronic protein indigestion is not very common, and when it is seen, it is usually accompanied by the loose, brown, musty-smelling stools. The treatment is to feed a food low in protein and high in carbohydrate.

**Starch Indigestion.**—I am not going to speak of *acute* starch indigestion because it is rare, and chronic starch indigestion is the more important. *Chronic* starch indigestion is often seen, especially in older children. In small babies it may occur when over 1 to 1.5 percent of starch is being fed in the diet. The symptoms are very much the same as those of fat indigestion. The stools are different; they may be brown and gelatinous, with many small, jelly-like particles scattered through them, or they may more rarely be loose and green, like the stools of sugar indigestion. The treatment, of course, is to cut out the starch and make up the deficiency with the other food elements.

Of course, this classification we have been discussing is not at all hard and fast, because when one type of indigestion is present, there may be also present some other type. Generally one type predominates, however, but the digestion may be also weakened for some of the other food elements.

You will notice that in discussing these nutritional disturbances I have not mentioned the salts. These are, of course, of very great importance, but we know so little about the metabolism of the salts, and the whole question of their rôle in nutrition is so complicated, that, with the present state of our knowledge, we can take them into very little consideration in practical feeding.

Now I want to talk about chronic fat and starch indigestion in older children. This is a common condition. I have seen a number of cases of this type since I have been here. The usual story is that there has been a good deal of trouble with the child's digestion from the first, and the trouble does not seem to improve much as the child grows older. These children may be anywhere from two to eight or ten years of age, and I have seen a typical case of "marasmus" from chronic starch indigestion in a child of twelve. These children are much under weight, and sometimes may be so much emaciated that they are little more than skin and bones. They are underdeveloped in every way, fretful and irritable, and, on the whole, pretty miserable-looking specimens.

The abdomen is usually considerably distended, and the chest apparently very small in relation to the abdomen. Rickets may or may not be present, and there is usually considerable anemia. *There is no use experimenting with different foods in these cases until the cause of the child's indigestion has been discovered. It is impossible to feed these children intelligently until the stools have been examined to see what the child is digesting and what it is not digesting, and by this make a diagnosis of the type of indigestion and regulate the food supply accordingly.*

**Fat Intolerance.**—In feeding these cases the utmost care is necessary, and it is usually very hard to manage them when the children stay at home, because the parents are likely to give them anything they want to eat. Generally the digestion for every food element is weak, but especially so for fat. For these

cases write out an absolutely iron-clad diet list, showing just what the child is to eat in the twenty-four hours. Most cases of this sort must be on a carefully regulated diet for a year or two years before the digestion returns to anything like the normal. Sometimes if a child gets to the table and eats a piece of butter the size of a pea it will be completely upset again. It is necessary to keep the child on a fat-free or a very low fat diet, the diet being made up mostly of starchy and protein foods. As to drugs, it is usually of a good deal of advantage to get these children cleaned out with castor oil once a week, as the intestines may be sluggish. Nux vomica is also a very good drug to give. For anemia, of course, iron is indicated. Needless to say, have the child get all the fresh air possible and live in a sensible and hygienic manner. Excellent results can be obtained with these cases if the family is intelligent and will carry out directions; but if one is dealing with an ignorant and stupid mother who will not carry out all directions absolutely, it is hopeless to expect to get good results.

You can, perhaps, get a better idea of cases of this sort by a discussion of a concrete case. This history is of a girl of five years who entered the Children's Hospital April 14, 1916. It is a very typical case of fat intolerance.

### History

*Past History.*—Normal delivery. Breast fed for five months. Birth weight, six pounds. After five months breast milk gave out and the child was put on Eskay's Food for a month. After this she was fed on barley gruel and whole milk. She did fairly well up to a year ago.

*Present Illness.*—About a year ago she began to have diarrhea. This diarrhea would last for about a week, then she would apparently be perfectly well for a while, when the diarrhea would return. During the periods of diarrhea she would have six to eight loose, light-colored stools in twenty-four hours, without mucus or blood. Most of the time she has been kept on a fairly careful diet, except that she gets off with the other children occasionally and eats a good deal of candy, etc. At these times her digestion appears to be especially upset, and she vomits and the diarrhea becomes more marked. No vomiting

at any other time. For the last week she has been so weak she has had to stay in bed, and has been on a diet of bread and milk, beef-juice, port wine, and albumin water.

Weight one year ago, 31 pounds; now, 18½ pounds.

*Short Summary of Physical Examination.*—Very poorly developed and nourished. Pale. Skin dry and loose. Glands, moderate general enlargement. Abdomen very large, tympanitic save in flanks, where there is shifting dulness. No fluid wave. No masses, spasm, or tenderness.

Stool brown, hard, smooth, alkaline; no mucus. Microscopically shows a large excess of neutral fat and soaps. No starch.

This girl was treated as follows: She was at first kept in bed, as she was too weak to stand. These drugs were given:

| | |
|---|---|
| Tincture nux vomica...... | 5 minims three times daily |
| Saccharated oxid of iron ... | 5 grains " " " |

Castor oil was needed about once a week, as she had a good deal of distention at times, and a thorough cleaning out occasionally seemed to help her a good deal.

The diet was scanty at first, but was gradually increased as she grew stronger.

April 15th she took:

| | |
|---|---|
| Zwieback.......................... | 3 slices |
| Beef-juice.......................... | 2 ounces |
| Cereal (farina)...................... | 3 tablespoons |
| Fat-free milk...................... | 24 ounces |

She improved rapidly, and was soon strong enough to be up and around the ward. The stools varied a good deal. Sometimes they were hard and constipated, sometimes they looked normal, and sometimes they were very loose and foul. The fat was never in excess while she was on the low fat diet.

May 9th she was taking:

| | |
|---|---|
| Cereal (farina)...................... | 1 tablespoon |
| Bread (stale)........................ | 2 slices |
| Zwieback.......................... | 3 " |
| Beef-juice.......................... | 3 ounces |
| Chopped meat...................... | 1 ounce |
| One egg | |
| Juice of half an orange | |
| Apple-sauce........................ | 2 tablespoons |
| Fat-free milk...................... | 24 ounces |

She was kept on practically this same diet until she was discharged, very greatly improved.

Her weight at entrance was 18 pounds 4 ounces.

Her weight at discharge was 24 pounds 8 ounces.

Average gain per week, 9 ounces.

I have not happened to see this particular girl since she left the hospital, but it is certain that if her mother has not dieted her strictly she is in just as bad condition as she was before she entered the hospital. If her mother takes pains to diet her carefully, she will probably get along very well.

**Starch Intolerance.**—The symptoms of *starch* indigestion are very much the same as those of fat indigestion. The stools are different, being brown and loose, with a great deal of jelly-like material. There is also likely to be a great deal of cellulose in the stools. Sometimes the stools of cases of starch indigestion may be green and watery, and sometimes may be extremely foul. If the diet of these children is investigated, it will be found that they eat a tremendous amount of starch in the form of hot bread, potatoes, etc., and also a good many green vegetables and fruits. The thing to do in these cases is to cut out the starch as much as possible. Of course it cannot be cut out entirely, because children of this age depend so much upon cereals. However, it can be cut down considerably, and coarse vegetables and fruits can be removed from the diet. The starch that is taken should be very thoroughly cooked. Any cereals these children take should be cooked overnight. The diet list should be written down. It can be practically the same from day to day, for most children do not at all mind a monotonous diet. The essential things are to feed a low starch, thoroughly cooked diet, cut out the fruit and coarse vegetables, and have all the food the child takes in as finely divided a form as possible.

## THE STOOLS IN INFANCY

There are a few points I want to mention about the stools in infancy. If any of you are interested, you will find the subject discussed more fully in Dr. Morse's "Case Histories in Pediatrics," which I have recommended to you before.

The examination of the stools is of very great importance,

both macroscopic and microscopic, and usually altogether too little attention is paid to it. It is perfectly obvious to any one that it is a rational and sensible thing, when dealing with a baby who has indigestion, to examine its stools carefully and get as much information as possible from this source. However, stool examination is not the whole story in infant feeding by any means, and the weight and general condition of the baby must also be considered. Stool examination is perhaps the most important guide we have, however, and if one is expert at it, a great deal may be learned about what is going on in the baby's intestine, by a careful examination of the discharges.

The reaction of the stools is sometimes of considerable importance. In the infant's intestine two processes are continually working against and counterbalancing each other: decomposition of fat and carbohydrates, with acid end-products, and decomposition of protein, with alkaline end-products. These two processes, under normal conditions, just about balance each other, so that a normal stool is either slightly alkaline, neutral, or slightly acid in its reaction. If the intestinal contents are too strongly acid or too strongly alkaline, trouble usually results, due to the irritant action in the intestine of the acid or alkaline end-products.

Some of the various types of abnormal stools seen are as follows:

1. *Fat Indigestion.*—The stools in this condition may be of a number of types:

(1) The "scrambled-egg" stool, acid smelling, loose, and with many soft, white fat curds scattered through it. With stools of this type there is also probably some sugar indigestion in addition to the fat.

(2) The "soap stool," usually a hard, light-colored, rather dry and crumbly stool, sometimes almost white. Typical soap stools are made up very largely of insoluble calcium and magnesium soaps.

(3) The oily stool. Sometimes in cases of fat indigestion the stool may be a light yellowish-brown color and very oily. These stools are not particularly common.

(4) Some stools which contain a large excess of fat may look perfectly normal macroscopically, but when examined under

the microscope will be seen to contain a large excess of fat. These stools are usually of a salve-like consistence.

2. *Sugar Indigestion.*—The stools of sugar indigestion are always strongly acid in reaction. They are usually loose, green, strongly acid smelling, and may contain fat curds, due to the fact that the stool has been hurried through the intestine so fast that the fat has not had time to be absorbed. The stools of mild sugar indigestion may sometimes closely resemble the "scrambled-egg" stools of fat indigestion previously described.

3. *Protein Indigestion.*—The stools of protein indigestion may be of two types. The first type is usually yellowish or light brown, and contains casein curds, which are smooth, tough, white, bean-shaped masses of coagulated casein. The second type is brown, loose, foul, strongly alkaline in reaction, and may be frothy or bubbly. This type of stool indicates that there is considerable decomposition of protein going on in the intestine.

4. *Starch Indigestion.*—The stools of starch indigestion are usually loose, foul smelling, rarely smooth or homogeneous, are brown in color, and are likely to contain small, brown, mucilaginous masses of partly digested starch, together with a good many coarse cellulose remains, such as seeds, pulp of fruit, etc. Occasionally the stools from cases of starch indigestion may be dry and crumbly or more rarely green and watery.

By all means the most common type is the one first described.

**Microscopic Examination of the Stools.**—The microscopic examination of the stools is important. By microchemical methods we test for fat or starch.

The technic of the fat test is as follows:

Place a small portion of the stool on a glass slide, add a drop or two of glacial acetic acid and a drop or two of a saturated alcoholic solution of Sudan III stain. Rub up the stool, acid, and stain together, and heat gently for a moment over an alcohol lamp. Examine with the low power of the microscope; the fat shows itself as small, orange-red globules. Nearly all stools contain a fair amount of fat, and whether or not the fat is in excess in any given stool preparation can be told only by a certain amount of experience with the method. If a baby is doing well in every way, it is not necessary to change the food if there is a slight excess of fat in the stool.

This method, used in this way, gives the total fat in the stool and does not differentiate between neutral fat, fatty acids, and soaps. What one wants to know in most stools is the total fat content, so I will not go into the technic for the differentiation of soap, etc.

The test for starch is simpler:

Add a drop or two of official tincture of iodin diluted 1 : 15 with 95 percent alcohol to a small portion of the stool, and examine under the microscope. Starch-granules stain dark blue. It is abnormal for there to be any but the very smallest amount of starch in a stool.

## CONSTIPATION

I will finish the lecture by talking very briefly about constipation. Constipation in small babies and in children during the second year is an extremely common condition and one hard to deal with. There may be a number of causes. The first is mechanical. The large intestine is relatively a good deal longer in a child than in an adult. The sigmoid flexure is longer and the mesentery is longer. There are thus a good many chances for kinks in the intestine, which may partially obstruct the passage of stools. It is well to bear in mind that this is certainly sometimes the cause in some of the severe cases.

There are a great many other causes, too, but we need not go through all, and will take up only the two most important. The first is atony of the abdominal muscles and intestine; the second is the character of the food.

In a great many babies constipation may be caused by the flaccid condition of the intestines and abdominal muscles. The child has not enough strength in its abdominal muscles to strain down and force out the feces. The abdomen is very flabby. Of course, the treatment of such a case as this is to increase the general strength and well-being of the child, if possible. Nux vomica is usually a good drug to use. In an older child exercise of the abdominal muscles is valuable. Of course, if there is anemia or any diseased condition, iron is indicated for the anemia and suitable drugs for the other conditions.

Constipation may be caused by either too little or too much

fat in the food. If the food is very low in fat, there is likely to be so much of the food absorbed that not enough is left in the intestine to cause a good movement of the bowels. If there is too much fat in the food, constipation may sometimes be caused by the formation of hard, dry "soap stools."

These are the most usual causes of constipation.

If a baby who is *supposed* to be constipated has a stool the moment his anus is irritated with a suppository or a piece of oiled paper, he has not constipation at all, but does not defecate simply because he is lazy and does not care particularly whether he empties his bowels or not. All that is needed in such a case as this is training.

What is to be done for a case of constipation? First, let me say that in a good many cases, no matter what is done, the results are poor.

**Diet.**—The diet is of great importance. If the child is fed on cereal waters, oatmeal is the best one to use, as it is somewhat irritating to the intestine and will help to cause peristalsis. If the child is not getting enough fat, give more; if it is getting too much, cut it down. Properly prepared green vegetables are of value, chopped-up spinach, celery, or carrots being very good. Orange-juice or prune-juice or finely scraped apple will sometimes help.

The malt-sugar preparations, such as maltine malt soup, are often of great value, as maltose is very laxative, and sometimes obstinate constipation in a small baby can be corrected by substituting malt for milk-sugar without any other measures. Dextri-maltose, however, is constipating, owing to its high content of dextrins.

**Drugs.**—In the atonic cases tincture of nux vomica is sometimes of great value, and may do more good than either diet or cathartics.

Iron is indicated if the child is anemic. "Eisenzucker" (saccharated oxid of iron) is the best preparation to use, as some of the other iron preparations have a tendency to cause constipation.

**Laxatives.**—Use laxatives as little as possible in the treatment of constipation; they may relieve the condition for a while, but do not get at the cause of it.

Such cathartics as castor oil and calomel should not be used; they are too irritating for continued use.

The best laxative for small babies is milk of magnesia, and for older babies and children, phenolphthalein, in doses of from 1 to 3 grains.

Agar-agar, which is a preparation of finely ground seaweed, may be of value. It is given in doses of a teaspoonful two or three times a day, mixed up with the child's cereal or potato. Of course, it cannot be used for babies who take only milk. It is not absorbed, but increases the bulk of the stool by swelling, which tends to cause a good movement.

The various mineral oils which are on the market are also of a certain amount of value.

Suppositories are bad for continued use as they establish a bad habit for the baby and make it think that it cannot have a movement of its bowels unless previously stimulated with a suppository. If enemas have to be used, plain soap and water ones are the best.

Constipation is a very fussy condition to treat, and requires a good deal of care. I have merely attempted to give a very brief summary of some of its most important aspects.

## LECTURE V

# DIARRHEAS OF INFANCY

1. Nervous.
2. Mechanical.
3. Fermentative.
   (*a*) Carbohydrate form.
   (*b*) Protein form.
4. Infectious:
   (*a*) $\begin{cases} \text{Dysentery.} \\ \text{Streptococcus.} \end{cases}$
   (*b*) Gas bacillus.

I am going to talk today about the diarrheas of infancy. There is a great deal of difference of opinion among various pediatric teachers and schools about the etiology and treatment of these diarrheas, so I have no right to speak dogmatically in discussing such a question, but am going to do so for the sake of clearness.

What is diarrhea? What causes diarrhea of any sort? Diarrhea is caused by increased intestinal peristalsis. That is at the bottom of every diarrhea, whether it be of a baby or of an adult. Increased peristalsis may be brought about by a number of causes, as follows:

1. Reflex nervous influences.

2. Irritation of the intestine mechanically by seeds, skins of fruit, improperly chewed food, etc.

3. Irritation of the intestine by injurious chemical products of food decomposition.

4. Bacterial infection of the intestinal mucous membrane.

What sorts of diarrhea are seen in infancy? Of course, all diarrheas are not the same, and it is not enough to say, in the case of any baby who has diarrhea, that it has "ileocolitis" or "summer complaint." It is necessary to diagnose the diarrhea more accurately and determine what type of diarrhea it is, and

to what it is due before it can be intelligently treated, for different sorts of diarrhea require different treatment.

### NERVOUS DIARRHEA

First of all, there is a nervous diarrhea. Such a diarrhea as this may be caused by infection or disturbance of one sort or another *outside* of the digestive tract, reflexly causing increased intestinal peristalsis, and thus a diarrhea. There is no question of any bacterial infection of the intestine in such a diarrhea as this. This type of diarrhea may be seen with otitis media, or with any acute infection which disturbs the equilibrium of the child. Again, nervous diarrhea may be caused by heat, by prostration, by teething, or by undue excitement. Nervous diarrhea is usually controlled by reducing the food. It is often best, in very hot weather, to weaken the food, and also during severe teething, or in acute infections, such as pneumonia, measles, etc.

### MECHANICAL DIARRHEA

Mechanical diarrhea is caused by irritation of the intestine by such things as seeds, skins of fruit, and various sorts of indigestible material. The child's intestine is much more susceptible to irritation of this sort than is that of the adult, and this is why it is wrong to feed raw fruit or coarse green vegetables to small children. There is nothing particularly to be said about this type of diarrhea. The stools always contain portions of undigested material, so the cause of the diarrhea is readily ascertained. A diarrhea of this type is likely to be accompanied by more gastric disturbance than are most of the other diarrheas of infancy and childhood. The treatment is thoroughly to empty the intestines with calomel or castor oil, to withhold food for twenty-four hours, and then to start in with a weak, easily digested food, keeping the child on a rather scanty diet for a few days, after which the regular diet may be resumed.

### FERMENTATIVE DIARRHEA

Fermentative diarrhea, the third type, is an extremely common condition. In Boston we see more cases of this type than of any other. Probably many of your cases, too, are of the fer-

mentative type. This is a diarrhea caused by the abnormal decomposition of food material in the intestine, giving rise to products which irritate the intestinal mucous membrane and cause diarrhea. *The mucous membrane is not attacked by bacteria in this condition.* It is simply the food in the intestine that is attacked and decomposed, and the resulting products irritate the intestine and stimulate it to increased peristalsis. Diarrhea of this type may be of two sorts—the carbohydrate form, in which the carbohydrates in the intestine are the substances that are being decomposed, with the formation of acid end-products; and the protein form, in which the protein substances are being decomposed, with alkaline end-products.

By all odds the most common type is the carbohydrate form, and this is the usual "summer diarrhea" that is seen in infants. It occurs especially in the summer, and is rarely seen in the cool months. The etiology may be due to many factors and conditions. It is unquestionably due partly to heat; but the exact way in which heat influences the baby is not well understood. It may be caused by feeding too much sugar to the baby, either as too high a sugar percentage, or as too much food at a feeding. The sugar is not absorbed, and what is left behind ferments. It may be caused by dirty milk, which carries into the intestine all sorts of harmful organisms: the Bacillus proteus, the gas bacillus, the colon bacillus, etc. There has been much discussion about the exact organism which causes fermentative diarrhea, but the question of the bacteriology of the intestine is so complicated that it is impossible to lay the blame at the door of any one organism. We know that usually it is caused by organisms of a number of different sorts which enter the body in contaminated milk, but we also know that it may be caused by the normal flora of the intestine, under certain conditions. Summer is, of course, the most favorable time for milk to become infected. If the milk is pasteurized or sterilized, or if it is certified milk, it is very unlikely to produce fermentative diarrhea, and the condition is not nearly so common among the better classes, who take good care of their milk, as it is among the poorer classes, who do not.

The prominent symptom of fermentative diarrhea due to carbohydrate decomposition is the passage of loose, green, acid

stools containing mucus. *The stools are always strongly acid and smell acid.* They are usually green. The number may vary a good deal—there may be three or four or five in a day, or twenty or twenty-five. The severity of the attack may vary a great deal. The child may appear not to be sick at all, but may have these stools; or there may be a great deal of toxemia, with high temperature, and the child may die. The temperature may be normal or may be very high. There is not a great deal of vomiting, because the condition is primarily an intestinal one, and the stomach has very little to do with it. The buttocks are likely to be red and irritated from the strongly acid stools. The abdomen in the severe cases may be sunken, also the eyes and the fontanel. Nervous symptoms are not so common as in true "infectious diarrhea." You have all seen so many of these cases that it is not necessary to discuss the symptoms further.

The sugar in the intestine is attacked by bacteria and broken down. Formic, acetic, and butyric, as well as many other acids are formed from the breaking down of the sugar. A certain amount of formaldehyd is also likely to be produced. It is surprising to see how much strong acetic and butyric acid may be recovered from the stools of babies with this condition, and when one realizes how much concentrated acid is present, it is easy to understand how tremendously the intestine is irritated by it.

Of course, in this condition the absorption of all the food elements is lessened, partly on account of the increased peristalsis and partly on account of the abnormal acidity of the intestine.

There is likely to be an acidosis present in a good many of the cases, partly due to the greatly increased loss of alkali in the diarrheal stools and partly due to the usually diminished excretion of the kidneys and the abnormal breaking down of body fat if the baby is not taking much milk.

The **prognosis** varies a great deal. It is usually very good in the mild cases in large, strong babies. It is doubtful or bad in the more severe cases in small, poorly nourished babies. Often a small baby will die in twenty-four hours from fermentative diarrhea.

**Treatment.**—You may be sure in any diarrhea that if the stools are green, acid smelling, and strongly acid in reaction the condition is due to sugar fermentation. What are the indications for treatment? As the condition is due to a sugar fermentation, *it is reasonable to give a milk as low in its sugar content as possible, to arrest this fermentation. If, in the food, a high protein content can be combined with this low sugar content, a good deal will have been gained, for the disintegration products of protein are alkaline in reaction and will help to neutralize the acid condition in the intestine, restoring it to its normal balance.* The withdrawal of sugar and the substitution of protein will also tend to inhibit the growth of the bacteria which have been causing the condition.

These are the principles of treatment.

*Details of Treatment.*—In severe acute cases it is usually better to starve the child for twenty-four hours, giving it merely water. In the milder cases starvation is not at all necessary. As to purgatives, personally I do not at all believe in giving them to cases of fermentative diarrhea due to carbohydrate, when the child is having 10 to 15 or 20 stools a day; as it is cleaning itself out, and it is not necessary to have any further cleaning. The intestine is already very much irritated, and it is poor therapeutics to irritate it any more. But if the baby is having only three or four bad-looking stools, by all means give a purge of castor oil or calomel to clean out the intestine. After the starvation period of twenty-four hours, feeding can be started. There are two or three different methods which can be used, but the principle is the same in all.

1. Start on skimmed milk and water dilutions, giving the baby such a formula as this: Skimmed milk, one-half; water, one-half. The percentage is this: Fat, 0; sugar, 2.25; protein, 1.6. Of course, no definite rules can be laid down for increasing the strength of the milk, as this will depend upon the clinical condition. Keep the fat low for a considerable length of time, also the sugar, and go up on the protein. When sugar is added, use a malt-sugar preparation instead of milk-sugar. Keep the sugar very low until the stools have become solid.

2. Another way of feeding these cases is by the use of "Eiweiss" milk, of which I have already spoken in the last lecture.

This is extremely satisfactory in such cases and they will get well much more quickly than with simply skimmed milk and water. The disadvantage is that Eiweiss milk is hard to make, but if one is dealing with an intelligent family, they can make this milk, and it is by all odds the best thing to feed these cases on, because one can get in it a much higher protein percentage and a lower sugar percentage than by any other means. Eiweiss milk has this composition, you remember: Fat, 2.5; sugar, 1.5; protein, 3.5; or if skimmed milk is used instead of whole milk, the fat is reduced nearly to zero.

3. There is another method: the use of skimmed milk and water mixtures to which powdered casein has been added. The great trouble about this is that it is hard to get powdered casein. There was a good product on the market some time ago called "Larosan," but I am not sure whether this can be obtained now. Buttermilk is also sometimes of value in feeding these cases, as it combines a high protein with a fairly low sugar content. So much for the feeding.

*Drugs.*—I do not wish to give the impression that drugs are of no value in treating this condition, but I distinctly do wish to give the impression that the regulation of the diet is by far the most important part of the treatment. It is very rarely necessary to give a drug of any sort to a baby with fermentative diarrhea.

*Purgatives.*—As I said before, purge the baby with castor oil or calomel if it has not already cleaned itself out well; if it is having numerous stools already, give no purgative. *It is a great mistake to give repeated daily doses of calomel or castor oil to a baby who is already exhausted by diarrhea.*

*Bismuth.*—Bismuth does very little good in fermentative diarrhea, and it obscures the stool picture, so one cannot tell the nature of the stool, and thus cannot regulate the diet intelligently. Proper food regulation will usually stop the diarrhea without using bismuth.

*Opium.*—Theoretically, opium is contraindicated because it is unwise to tie up the intestine and thus favor absorption of toxic material. Practically, when a baby is having many watery stools a day, with a good deal of straining and tenesmus,

with perhaps a prolapsed rectum, it is wise to give opium in some form, usually paregoric, to relieve it.

*Intestinal Antiseptics.*—The intestinal antiseptics are of very little value in treating fermentative diarrhea: if you give enough to sterilize the intestine, you give enough to kill the baby. Bulgar tablets, which are so commonly used, are very likely to be inactive, and I am very skeptical about their value, even if they are active.

*Colonic Irrigations.*—The trouble in fermentative diarrhea is usually so high up in the intestine that little benefit is to be obtained from colonic irrigation.

*Fluid.*—It is extremely important to give the baby plenty of fluid, either by mouth, rectum, or by subcutaneous injection, if necessary. Next to the feeding, this is the most important part of the treatment.

*Alkalis.*—Theoretically, it would seem that as the trouble in fermentative diarrhea due to carbohydrate fermentation is caused by the excessive production of acid in the intestine, alkalis would be indicated. Practically, it is much easier to change the reaction of the intestine by the use of suitable food than by alkalis. In certain cases of fermentative diarrhea there may be a good deal of acidosis, however, which may be manifested by rapid and labored breathing, by stupor, or by extreme restlessness. If acidosis is suspected, an alkali is indicated. Sodium bicarbonate may be used, either by mouth or by rectum, usually best by rectum, as it has a good deal of tendency to upset the stomachs of small babies.

You will see that I am somewhat of a drug nihilist as regards this condition; to my own cases I rarely give a drug, with the exception of an occasional dose of opium or castor oil. I understand perfectly that a doctor has to give drugs to many people if he wants to keep them as patients, and do not believe that such drugs as bismuth, salol, etc., do any harm.

In fermentative diarrhea due to protein the general symptoms are very much the same as in the carbohydrate form, which we have been discussing, except for the stools. The stools in protein fermentative diarrhea are loose, watery, brown, and rather musty or foul smelling, *and they are alkaline in reaction.* The condition is due to decomposition of protein in the intestine;

therefore it is treated by giving a milk low in protein and high in carbohydrate. The first food which it is usually best to give is a 5 to 7 percent solution of milk-sugar, to which barley water may or may not be added, keeping the protein low for a while, and gradually increasing the strength of the food by adding skimmed milk or whole milk, and more sugar. These cases will usually do well with proper treatment, but some of them may be troublesome. The general treatment is the same as for the carbohydrate form. A hundred carbohydrate cases are seen to one of the protein type.

## INFECTIOUS DIARRHEA

Infectious diarrhea is the type of diarrhea that most of you see down here. It is called by different names: ileocolitis, dysentery, etc. This condition may be due to a number of organisms, which may be divided into two groups,—the dysentery bacillus and the streptococcus,—which I put together because the treatment for them both is the same; and the gas bacillus group, for which the treatment is different. As you will note, this classification is based on the treatment. The etiology is infected milk in nearly all cases, and if the disease is seen in breast-fed babies, it means they have been having some food in addition to the breast milk, or may possibly have received the infection through water.

*In infectious diarrhea there is an actual invasion of the intestinal mucous membrane by bacteria; thus it is a different thing entirely from fermentative diarrhea.*

First of all I want to speak of the gas bacillus type. There has been a great deal of discussion, especially in Boston, as to just what rôle the gas bacillus plays in infectious diarrhea. We find it in a certain number of cases, and we know that when we get rid of it the cases improve a great deal. From that line of reasoning we consider that in these cases the gas bacillus is the cause of the disease. Some men say that it has nothing at all to do with it, and that it is simply present in the intestine, doing little harm, and that the infection is due to the dysentery bacillus, and that if a man will look for that carefully enough he will always find it. Personally, I think most cases are

caused by the dysentery bacillus, but I do believe that a certain number of cases are caused by the gas bacillus. It is important to differentiate them because the treatment is different for each type. This must be done by stool cultures. Clinically, the two cannot be told apart except that the dysentery type is likely to be a little more severe. We will speak of the differentiation of the two types a little later.

Let us take up the dysentery type, which is the one usually seen. The trouble is in the large intestine and in the lower part of the small intestine. There may be only a catarrhal inflammation present, or there may be small superficial ulcers or deep ulcers. The symptoms may vary considerably according to the severity of the infection. The onset is likely to be sudden. The stools may vary a good deal in number, as many as 20 or 30 being passed each day. They may be very small, usually only small amounts of blood and mucus, pus, and slime being passed after the first day or two. Some cases may show extreme nervous systems, much resembling meningitis at the onset. The only way to rule out meningitis is to do a lumbar puncture and examine the spinal fluid. The temperature may vary a good deal, in some cases being very slight, in others very high; in most cases it is moderate, but continuous. The evidences of toxemia are usually severe, and these babies certainly are very sick in the great majority of cases. You have all seen so much infectious diarrhea that it would be a waste of your time to go further into the symptoms.

**Treatment.**—A good many different methods of treatment have been used for the condition. The principle to remember is this: *The dysentery bacillus lives upon protein food much more readily than it does upon carbohydrate, and the products which it forms from protein are much more toxic than the products from carbohydrate, so feed these cases on a low protein diet and a fairly high carbohydrate, giving the baby as much food as it can reasonably take without being upset. Carbohydrate food tends to discourage the growth of the dysentery bacillus—protein food encourages it.* That is the principle of the treatment of cases of diarrhea due to the dysentery bacillus or to the streptococcus. It is usually best to give these cases an initial purge of calomel or

castor oil, then starve them for twenty-four hours, giving nothing but a 5 or 6 percent sugar solution. We used to starve them for as long as ten days at a time, but have stopped that, because we found out that they do a great deal better if they are not starved so long. We start the feeding by adding barley water to the sugar solution, and later add skimmed milk to this. Some of these children do not like to eat, but they have to have fluid and they have to have food, so feed them with a stomach-tube if they will not take the milk.

The gastric symptoms are usually not severe, so there will, in most cases, not be much vomiting. If there is vomiting, the thing to do is to wash out the stomach and stop the food for a few feedings.

There are no definite rules that can be laid down for the feeding of these cases. Size up each case and remember the principle of fitting the food to what the individual baby can take, keeping it rather low in protein and high in carbohydrate, and, especially during convalescence, low in fat, because the digestion of fat is very poor during the whole course of the disease and convalescence. A prominent pediatrician said last year that he had come to the conclusion that the best way to treat infectious diarrhea was to consider a case very much as a case of typhoid fever. This is sensible, for the dysentery bacillus is closely allied to the typhoid bacillus, and the pathology of the two conditions is somewhat the same.

To clinch the question of feeding these cases, let us take a supposititious case and feed it; but remember that this particular feeding might apply to one baby, and not to another.

Let us say that our patient is sixteen months old, and is seen the first day he is taken sick, and has had four stools with blood and mucus.

1. A purge—castor oil or calomel.

2. Withdraw food for twenty-four hours, giving plenty of water—8 ounces every three hours, sweetened with saccharin, if necessary.

3. Start feeding with a solution of 8 percent lactose, giving water between each feeding.

Lactose solution, 8 ounces every three hours. Water, 4 ounces between each lactose feeding.

4. After a day of the lactose feeding add 1 percent barley starch to the sugar solution. Feed this for twenty-four hours.

5. Feed lactose and starch solution, 7 ounces, skimmed milk 1 ounce.

Gradually increase the skimmed milk in this feeding until, when the baby is nearly well, he will be taking possibly this:

| | |
|---|---|
| Skimmed milk | 6 ounces |
| Barley-water | 2 ounces |
| Dextri-maltose | 1 dram |

Soon to this can be added barley jelly, three tablespoonfuls a day, and if he takes this well, powdered zwieback can be given. The last thing to do is to increase the fat in the food, and this is done by substituting an ounce of whole milk for an ounce of skimmed milk until the baby is taking entire whole milk.

Of course, this feeding would have to be modified for a younger baby, and a weaker milk would be given, but the principle is the same.

As to the rest of the treatment, *the most important single thing in the whole treatment is to keep the baby filled up with fluid. If* it cannot be given by mouth or by rectum, it will have to be given subcutaneously. This is not hard to do. *Do not let these babies get dried out.* Give them salt solution under the skin right away: a teaspoonful of salt to a pint of water. More babies die from getting dried out in this disease than from any other one thing.

For excessive fever, the best treatment is baths—a sponge-bath of one-half alcohol and one-half water, at 80° F., or a fan bath, wrapping the baby in cheese-cloth, sprinkling it with water, and fanning him, or a cold bath at 70° F. Do not give anti-pyretic drugs—they are all depressants. Some babies have a subnormal temperature and have to be stimulated by hot-water bags or hot salt solution by rectum. Colonic irrigation may be of some value in treating the disease, and will do no harm. If it does not disturb the baby, it is a good idea to give one once a day, of normal salt solution or 4 percent sodium bicarbonate solution. In cases that do not clear up well and continue to have pus in the stools too long it is sometimes well to use a 2 percent solution of silver nitrate for the irrigation.

*Drug Treatment.*—About the same may be said of the drug treatment of infectious diarrhea as was said for fermentative diarrhea.

*Purgatives.*—Purgatives are indicated in the beginning of the disease, or during its course if the number of stools drops suddenly and there seems to be a good deal of toxemia. *I think it is extremely bad practice to give a purge every day as a routine.*

*Bismuth.*—Bismuth may do some good in coating over the ulcers in the intestine, and by tending to decrease excessive peristalsis. The subcarbonate of bismuth is better to use than the subnitrate, as there is less danger of poisoning by absorption.

*Intestinal Antiseptics.*—These drugs do little good in infectious diarrhea, for the organisms that cause it are likely to be deep down in the ulcers under the mucous membrane and they cannot reach them. Also, large enough doses really to be valuable would probably kill the child.

*Opium.*—The indications for opium in infectious diarrhea are the same as for the fermentative type.

*Stimulants.*—Stimulants may be needed if the child is much prostrated. Strychnin, camphor, caffein, or alcohol may be used. Personally, I prefer caffein sodium benzoate given subcutaneously.

*Chloral and Sodium Bromid.*—These drugs are indicated for restlessness. Children bear them well, and they may be given in good-sized doses.

Now for the gas bacillus type of diarrhea: The treatment in this condition, that is, the food treatment, is different from the treatment of the dysentery type; the rest of the treatment is just the same. The gas bacillus is an organism that thrives on carbohydrate food, so it is absolutely wrong to feed a child with a condition due to the gas bacillus on carbohydrates. The gas bacillus cannot flourish if there is a good deal of lactic acid in the intestine, and these cases will sometimes do remarkably well on buttermilk or on lactic acid milk. I do not believe that the bulgar tablets are usually of much value, because they are so likely to be inactive, and buttermilk or lactic acid milk made with a liquid culture is much better.

The rest of the treatment for this type is just the same as for the other types. The feeding is the only point that is different.

Get just as much buttermilk or lactic acid milk into the child as possible and keep the carbohydrates low.

Most cases of infectious diarrhea are of the dysentery type, so the treatment usually will be for this type. The gas bacillus can be tested for very easily by putting a small portion of the stool into a test-tube of milk, boiling it for three minutes, then stopping it up and incubating it for twenty-four hours. If the gas bacillus is present, the casein will be coagulated, will be full of holes, and will smell like rancid butter, due to the formation of butyric acid from the fat and sugar in the milk.

Usually, if a "gas" case is fed on a high carbohydrate food, as would be done for a dysentery case, the temperature will go up, and the baby will be sicker, so if this happens, it is fair to assume that the other type of treatment, that is, with buttermilk, is indicated.

How is one to tell infectious diarrhea from the fermentative type? Ordinarily in the fermentative form the child is not so ill. In this type, too, *there is usually no blood in the stools, and there is never any pus.* In infectious diarrhea there are nearly always blood and pus in the stools. Another thing, the temperature in fermentative diarrhea rarely continues elevated for more than a day or two. In infectious diarrhea it continues elevated for a number of days.

Sometimes when called to a case it is impossible to tell at the first visit which type of diarrhea it is. Under such conditions it is safe to clean the baby out and starve it for twenty-four hours, and by this time a decision one way or the other can usually be made. Another condition with which infectious diarrhea is sometimes confused is intussusception. In this condition the abdomen is likely to be distended: in infectious diarrhea it is usually sunken. A tumor may be felt in intussusception, and not in infectious diarrhea. All the symptoms in intussusception are likely to be more severe, and vomiting is prominent. The stools in the two conditions may look almost exactly the same, but if there is much fecal material present with the blood and mucus, the case is more likely to be one of infectious diarrhea.

The subject of these diarrheas is an extremely difficult one to present in a clear and clean-cut manner, for the reason that no

two people will say the same things about them, and I know perfectly well that there is plenty of room for criticism and difference of opinion about the things I have been telling you today. I have not spoken of the old-fashioned "cholera infantum" that most of you older men have seen, as it is fortunately a very rare condition today, and we practically never see it in Boston.

There will be no more lectures on feeding, and I want to give you a very brief summary of the central ideas of the subject—a bird's-eye view of the whole.

The subject of infant feeding is seemingly in chaos—what is believed in Boston is not believed in Chicago, what is believed in Berlin is not believed in New York, and so on; what is regarded as gospel in one city by one group of pediatricians may be looked upon as of very little consequence by an equally capable group of pediatricians in another city. It is obviously not just or reasonable to suppose that intelligent pediatricians in one city do not know how to feed babies because they use methods which are different from those used by their confrères in another city, and still each group of men firmly believe that its own methods are the correct ones, which is only natural. I suppose that if the end-results of the feeding work of men of equal experience in the various cities, using different methods, were to be compared, these results would be found to be very similar; we get at things in different ways, *but get there*.

I have endeavored to teach you Boston ideas of feeding entirely, and have paid no attention to the ideas of men who have different methods than ours; not because I believe that they are of no value, but because I believe our methods are the most reasonable and logical, and because it is best to save confusion by learning one method instead of skimming over several.

Let us consider what the basis of the Boston method is:

1. *A baby must have a well-balanced food.*
2. *He must have enough of it in fuel value.*

These two propositions are self-evident, and will be admitted by every one, no matter what methods of feeding he uses.

*We believe, in Boston, that most of the digestive troubles of babies (exclusive, of course, of such conditions as infectious diarrhea) are caused by an excess or a deficit of one or more of the food elements in*

*the milk—fat, sugar, protein, or salts—or to a faulty digestion or absorption of one or more of these elements when they are perhaps in normal quantity in the milk. Therefore it is reasonable and essential to know approximately how much of each of these elements is in the milk that we feed to any baby. The most convenient and accurate way of expressing this quantity is by percents of the various elements. We take into consideration the elementary composition of the food, and also the fuel value of the food as a whole, as expressed in calories, or heat units. We determine what food element or elements are causing the baby trouble, by a study of his diet, himself, and his stools, and regulate the subsequent food supply by an increase or diminution of an element or elements of the food, or of the total quantity of food, according to the indications thus determined. We lay especial stress on the examination of the stools, macroscopic and microscopic, and believe that such examination helps a great deal in the proper regulation of the baby's diet by giving us a guide as to what he is or is not digesting.*

This is a brief exposition of the principles upon which "percentage feeding" is based: there is nothing complicated about it; rather it tends to make a difficult subject clearer—it is rational, practical, and scientific at the same time, and its principles and practice can be grasped by any one who will take the trouble to give it a little thought.

## LECTURE VI

# PYLORIC STENOSIS—PYLORIC SPASM—INTUSSUSCEPTION—ACIDOSIS

In the lecture today I am combining several subjects, which, although unrelated, will be put together into one lecture, as any one of these subjects alone is hardly important enough to you to devote a whole lecture to it.

First, let us consider pyloric stenosis and pyloric spasm.

*Pyloric stenosis*, or "congenital hypertrophic stenosis of the pylorus," as it is sometimes called, is a congenital hypertrophy of the circular muscle-fibers of the pylorus, which causes a stenosis of the orifice.

*Pyloric spasm* is a condition in which there is a nervous spasm of the pylorus which causes a stenosis. Pyloric spasm may sometimes complicate a true organic stenosis, or it may exist independently.

## PYLORIC STENOSIS

**Symptoms.**—A baby, breast fed or bottle fed, will usually start to vomit when it is anywhere from a few days to a month old. This vomiting, in true stenosis, rarely begins after the first month. The vomiting at first may not be very severe, but in a few days it becomes projectile, and the vomitus may be shot out of the mouth to a distance of two or three feet. The child will vomit whatever it eats, and the vomiting is uncontrollable by drugs of any sort, as can be readily understood from the pathology of the condition. There is no evidence of any indigestion, as shown by colic, diarrhea, etc., and the child is hungry. The child loses tremendously in weight, due to the fact that it gets practically no food into its intestine. The stools are very small in size and constipated, as little food goes through the pylorus. These are the important symptoms —the explosive vomiting, the loss in weight, and the small size

of the stools. The condition occurs with equal frequency in breast- or bottle-fed babies.

There is very likely to be a considerable dilatation of the stomach in true pyloric stenosis; and there may also be visible peristalsis excited by stroking the skin over the stomach, the peristaltic waves running from left to right across the abdomen. They will not be seen unless there is something in the stomach. There may also be felt a small tumor—the enlarged pylorus. This tumor is usually midway between the tip of the ensiform and the umbilicus, about ½ inch to the right of the midline. In some cases it may not be felt at all, but in the majority it is if it is felt for when the abdominal muscles are relaxed. The tumor is usually about the size of a small olive, and about the same shape.

**Prognosis.**—With proper treatment, a great many of these cases can be entirely cured. If the case has been let go too long, until the baby is exhausted and has wasted away to skin and bones, the prognosis, of course, is a good deal worse, and many will die if they are let go too long without treatment.

**Treatment.**—Medical treatment is of no value in dealing with these cases of hypertrophic stenosis of the pylorus. Surgery is indicated at once, as soon as the diagnosis is made, and the sooner the operation can be done, the better off the child will be. There are two sorts of operation that may be done: first, a posterior gastro-enterostomy, thus short-circuiting the pylorus and letting the food go through the new opening, and, second, splitting the circular muscle-fibers of the pylorus. This last is considered the better operation, and most of the men are now using it. It takes only about twenty minutes to do, and there is very little shock to the baby. The treatment both before and after operation is important. About half an hour before operation the baby's stomach should be washed out. After the operation, salt solution should be given by rectum in order to get plenty of fluid into the baby, and it is of great importance not to feed the baby very much for a considerable time after the operation, because the intestines are so collapsed and atrophic that the baby cannot digest the food. Breast milk, of course, is the best food to use if it can be obtained, and this should be given diluted with two parts of water, in dram feed-

ings, every hour. After the first twenty-four hours the amount and strength of the feeding can be gradually increased. When breast milk is not available, the next best thing is whey. When it is desired to increase the fat in the feeding, small amounts of 16 percent cream can be added. The whey is given at first in dram feedings every hour and soon increased.

So much for pyloric stenosis. It is not a particularly common condition, but important to recognize when it is seen.

## PYLORIC SPASM

Pylorospasm is a condition of the pylorus in which there is nervous spasm, but no organic stenosis. It is more common than pyloric stenosis. Pylorospasm is likely to occur in babies of rather nervous temperament, who come from nervous parents. The symptoms are very much the same as those in pyloric stenosis, but are likely to be not so severe. The difference is one of degree rather than of kind. Pylorospasm is much more likely to be seen in bottle-fed than in breast-fed babies, whereas pyloric stenosis occurs with equal frequency in breast- or bottle-fed babies. The vomiting *may* start immediately after birth in pylorospasm, but usually not until several weeks, or sometimes not until two or three months, after birth, and it is not so severe as in true pyloric stenosis. The rest of the symptoms are the same, but not so severe as in pyloric stenosis. The baby loses a great deal in weight: the stools are small and constipated. The vomiting is likely to be not so explosive. The stomach is usually not nearly so much dilated as in true cases of pyloric stenosis.

**Physical Signs.**—A tumor may be felt, but the tumor is longer and thinner than in cases of stenosis, and sometimes this tumor can be felt contracting and relaxing under the finger. Visible peristalsis is not so common as in true stenosis. It is usually not difficult to decide that the case is one of stenosis *or* spasm. What it must be differentiated from is simple indigestion. That is not hard. The vomiting in simple indigestion is not projectile, and the symptoms are not so severe. There is no evidence of indigestion in cases of pyloric stenosis or spasm. $x$-Ray examination after a bismuth meal is also of value, as it shows

that there is difficulty in the passage of the food through the pylorus. The trouble comes in differentiating stenosis from spasm. How is one to distinguish between these two conditions?

First of all, spasm is rarely seen in breast-fed babies, and stenosis may be seen in both. The vomiting in spasm is likely to start a good deal later than in stenosis, and it is not so severe and is not so explosive. The stools are larger in spasm than in stenosis. A tumor may be felt in both conditions, and in spasm it is longer and thinner than in stenosis and it may contract under the finger. A tumor is much more likely to be felt in stenosis than in spasm. The stomach is likely to be more dilated in stenosis than in spasm. Visible peristalsis is not so commonly seen in spasm as in stenosis.

In mild cases of spasm the signs and symptoms of stenosis, such as palpable tumor, visible peristalsis, extremely explosive vomiting, etc., are not seen. In severe cases of spasm the signs and symptoms may be almost identical with those of stenosis, and the differentiation may be impossible. Severe cases of spasm must be treated in the same way as cases of stenosis.

**Treatment.**—A great deal may be done for some cases of pylorospasm by proper treatment. The most important thing is the regulation of the food supply. Breast milk is indicated if it can be obtained. A food low in protein should be given, adding sodium bicarbonate or lime-water to prevent the formation of large curds, for these pass a narrow pyloric opening with great difficulty. Feed a food low in protein and fat and high in sugar. Sometimes hot applications to the abdomen before the feeding are of value. The drugs indicated are atropin and opium in some form a half-hour before each feeding. Washing out the stomach several times a day with sodium bicarbonate is also of value. Sometimes, no matter what treatment is used, operation will have to be resorted to. If medical treatment has been tried faithfully for a considerable time and the child does not get better, the case must be operated on. The operation is the same as for pyloric stenosis.

## INTUSSUSCEPTION

I want to talk now about intussusception. What is intussusception? Intussusception is an invagination of one part of the intestine into another part. This is most likely to be an ileocecal invagination, but may occur in any part of the intestine. It is most often seen in small babies and children, and is a very important condition to recognize immediately when it is seen. The etiology is rather obscure. A certain number of cases will be seen during the course of a severe diarrhea, and a few cases may be due to trauma. Some are due to kinks or malformations in the intestine. It is also occasionally seen in severe cases of purpura.

**Symptoms.**—The onset is usually sudden. A previously well baby is taken with severe abdominal pain and vomiting. The stools consist of blood, mucus, and fecal material. After a few stools have been passed they no longer contain fecal material, but only blood and mucus, and they are small in size. The symptoms become very severe, with considerable shock and prostration. There may be a fairly high temperature. In a good many cases a sausage-shaped tumor may be felt, usually in the left side of the abdomen, or if it cannot be felt through the abdominal wall, it may be felt by rectum. Sometimes this tumor may be seen, the intussusception projecting out of the rectum. In Dr. Holt's series the tumor was felt in 86 percent of the cases.

Sometimes the diagnosis is difficult, especially in the subacute cases, where the symptoms are not so marked. The main thing intussusception must be distinguished from is infectious diarrhea, and a good many cases of intussusception are wrongly diagnosed as infectious diarrhea. Infectious diarrhea does not usually come on so suddenly, and in this condition the abdomen is likely to be sunken. In intussusception it is often distended. One cannot tell much from the stools, because they may look very much the same in both conditions. The temperature is likely to be higher in infectious diarrhea than in intussusception. Not much can be told from the condition of the child, because it may be extremely prostrated in both conditions; but usually there is more shock in intussus-

ception—it is not so likely to be in most cases of infectious diarrhea.

**Treatment.**—*Operation right away!* As soon as a diagnosis of intussusception is made, call in a surgeon and have him operate immediately. Often a delay of six or eight hours in operating will cost the life of the child, because the operation should be done when the child is in as good condition as possible. It is true that some cases of intussusception will reduce themselves spontaneously, and that others may be reduced by the injection of water into the bowel. This is altogether too uncertain to be depended upon, however. The prognosis is not a good one. In about 50 percent of the cases the child dies. The prognosis depends, more than anything else, upon how soon the child is operated upon after the diagnosis is made.

The following three histories, taken from the Children's Hospital records, may serve to give you a better idea of the symptoms:

*Case 1.*—C. O., seven years. Five days ago an eruption was noticed on legs and thighs, which was composed of areas the size of the tip of the little finger, level with the skin and of a purplish color at first, changing to brownish red.

These spots faded slowly and disappeared almost entirely in three days. At this time the legs and feet were swollen (typical purpura).

Two days ago a diarrhea began, which was composed entirely of fecal matter at first, but in a few hours was practically all blood, very little mucus, and no fecal matter. Has been vomiting a great deal of greenish-yellow, liquid mucus, occasionally blood streaked. Moderate pain in the right abdomen.

Hasty examination shows a large tumor in right lower quadrant. Abdomen distended and tympanitic; general condition fair. Transferred surgical and operated. *Intussusception found.*

*Case 2.*—D. M., eighteen months. (Illustrating the subacute type of case.) Three weeks ago the child fell from a chair to the floor. His father says that when he picked up the baby he felt a lump on the abdomen which soon afterward disappeared. The child played and acted normally the rest of the day, but that night began to vomit. A doctor was called, and after he

had taken a rectal temperature the baby passed some blood and mucus. An enema given immediately afterward gave no results. Since then he has vomited occasionally. The stools are dark, with some mucus and blood.

One week ago he had another more severe vomiting attack. Bowels have moved twice daily for the past week—dark in color. No blood noted. One day ago the stool was dark, with streaks of fresh blood. Today he had four stools, dark in color, with considerable mucus, but no blood.

Has been vomiting all day and has complained of pain in stomach region.

P. E.: In fair general condition. Abdomen: Full, rounded, tense, tympanitic; muscular resistance is general, but more marked on left side. Some tenderness on left. No tumor felt. Rectal negative.

*Day After Admission.*—Child has appeared fairly comfortable since admission, but has complained of moderate abdominal pain at times. Has vomited all food taken. One stool obtained contained mucus and blood. P. E.: In the abdomen is felt a definite, sausage-shaped tumor in left iliac region.

Rectal examination shows resistance on left.

Transferred surgical—operated, and *intussusception found.*

*Case 3.*—R. M., seven months. Eight days ago he began to draw up his knees and scream. A doctor who was summoned called it "stoppage of the bowels." He administered a suppository without result. He then gave an enema and got a stool. Castoria was then given and normal stools followed.

Three nights ago he began to vomit. He vomited ten times during the next day and has vomited frequently since—not projectile, no bile or blood. Last vomitus was at 1.15 this afternoon. This "looked and smelled like a bowel movement." Bowels moved five times yesterday and at 2.30 this morning. No blood in stools. Mucus in stools yesterday and the one this morning was mostly mucus containing a little fecal matter.

P. E.: In good condition. Abdomen negative. Rectal negative. Next day vomited continuously all day; twice had fecal vomiting.

Transferred surgical and operated. *Intussusception found.*

## ACIDOSIS

Acidosis is a condition which has been discussed a great deal of late; many investigators are working on problems connected with it; but its causation and exact nature are still very imperfectly understood. I can hope to do no more than give you a very superficial view of this complicated subject, and, as I said before, when discussing the diarrheas of infancy, it is hardly fair to speak dogmatically in discussing such a subject; but I shall do so for the sake of clearness.

What is acidosis? Normally the blood is slightly alkaline in reaction. This alkalinity is maintained in the body by a number of factors. When the degree of alkalinity becomes lessened and the blood more nearly approaches a neutral reaction, a condition of acidosis results. Acidosis is thus a diminution of the alkalinity in the blood.

What may cause a diminution of the alkalinity of the blood? First of all, there may be an *increased acid production,* such as occurs in diabetes or in starvation. This increased production of acids occurs when fat is being broken down in the body, especially when carbohydrate food is withdrawn and the fat supply of the body is broken down and imperfectly oxidized. These "acid bodies," as they are called, are acetone, diacetic acid, and betaoxybutyric acid.

Another way in which acidosis is produced is by a *decrease in acid elimination.* The normal acidity of the urine is due to acid sodium phosphate in solution. If there is no excretion or very little excretion of this substance, due to anuria, and it is retained in the body, it tends to produce acidosis. This condition may occur in the diarrheal diseases of infants when there is anuria.

*A loss of alkali* from the body may help to produce acidosis. This may occur in fermentative diarrhea, where there is a tremendously acid condition in the intestine. The alkali reserve of the body is drawn upon to neutralize this acidity, and a large amount of alkali may be lost in the stools in this way. These three causes may singly or together produce acidosis.

As Dr. Marriott, of Johns Hopkins, has said, "acidosis" is a term which is used very loosely. It is used by most people to

indicate that a child has acetone or diacetic acid in the urine. Strictly speaking, it is true that a mild acidosis is present when these substances are found in the urine, but they will be found in the urines of many children who have no clinical signs of acidosis, and should be looked upon rather as a symptom than as anything else, and no treatment is indicated, nor is there cause for worry unless clinical symptoms of acidosis are present in addition to the presence of acetone in the urine. It is surprising, in a routine examination of the urines from many sick children, to see how many of these contain acetone. Acetonuria may be regarded in much the same way as fever is: we do not need to worry about fever unless it is excessive: we do not need to worry about acetonuria unless it is severe and has other symptoms of acidosis along with it. Acetone will be found in the urines of most children ill with acute fevers. What are the tests for acetone and diacetic acid in the urine? They are both simple.

**Tests for Acetone and Diacetic Acid in Urine.**—*Acetone.*—To 5 c.c. of urine in a test-tube add a small crystal of sodium nitroprussid and a few drops of strong acetic acid, and shake. Make alkaline with ammonium hydroxid. A purple color indicates acetone.

*Diacetic Acid.*—To 5 c.c. of urine in a test-tube add an excess of a 10 percent solution of ferric chlorid. A dark brownish-red color indicates diacetic acid. After the taking of certain drugs, especially aspirin, such a reaction may be obtained in the urine, and the color *does not* disappear on heating. The red color, if due to diacetic acid, disappears on heating.

**In What Conditions is Acetone Likely to be Found in the Urine?**—*Starvation.*—When a person takes little or no food for a day or two, there is likely to be acetone in the urine, due to the breaking down of the body fat which is being used for food. This is probably one reason why acetone is so often found in the urines of fever patients: they eat very little. This type of acetonuria is also likely to be seen after surgical operations upon children; whether it depends upon starvation alone, or whether other factors as well enter into its production, is not certain.

*Diabetes.*—Acetone and diacetic acid occur very frequently

in the urines of diabetic patients, as you all know. This is probably due to the breaking down of ingested or body fat.

*Fever.*—Acetone is likely to occur in the urine of a patient with any febrile disease. Whether this is due to the fact that these patients eat little, or whether it may be due to some peculiar effect of fever on the body metabolism, is not certain.

The three types of acetonuria that we have been speaking of are not peculiar to childhood—they do not interest us particularly.

**Types of Acidosis Peculiar to Children.**—*Diarrhea.*—There may be an acidosis accompanying certain diarrheas of infancy.

*"Recurrent" Vomiting.*—In cases of so-called recurrent vomiting in children there is usually acetone in the urine, and sometimes other evidences of acidosis. In some cases this is probably present secondary to the vomiting, and is due to the fact that the child eats nothing; in others it may be primary, and the vomiting be due to acid intoxication, the whole disturbance being caused by some peculiar derangement of metabolism of which we know little.

*Severe Acid Intoxication; "Epidemic" or Periodic.*—Let me say at the start that there is really no such thing as true epidemic acidosis. There *is* a severe acidosis which occurs in epidemics secondary to influenza or other nasopharyngeal or respiratory infection, but the epidemic is not of "acidosis" itself. This is the most interesting type of acidosis, the most severe, and the one which I want to talk of particularly.

How is one to tell, when acetone is found in the urine, whether or not the condition is severe enough to worry about or to call for any particular treatment? The amount of acetone and diacetic acid in the urine is not a good index of the severity of the acidosis, for severe acidosis may occur with very little acetone in the urine, or mild acidosis with a good deal of acetone in the urine. There are a number of methods of determining the degree of acidosis and expressing it quantitatively, the two most important of which are analyses of the alveolar air and of the blood itself. I merely mention these, as they are hardly practical for the average physician to use.

For practical purposes, if a child has acetone and diacetic acid in the urine, is restless and vomits, and has deep, labored

breathing without cyanosis, one may decide that there is acidosis present and start immediate treatment.

Certain children seem to be subject to periodic attacks of acid intoxication, and may have an attack every few months. I well recall one child of five who was in the Children's Hospital with acidosis six times in ten months. She was extremely sick in each attack, with identical symptoms each time she entered. These periodic attacks of acid intoxication are similar to the "epidemic" cases.

What is the etiology of the condition? Some of the cases seem to be secondary to acute indigestion, some secondary to exhaustion or severe nervous disturbance; the child's equilibrium is very unstable, and its body chemistry can be easily upset. It is difficult to explain the epidemic cases on any other basis than that of an infection—the epidemic in Boston last spring occurred when there was a great deal of respiratory infection of various sorts about, and in many of the cases the tonsils or nasopharynx was inflamed and swollen. Personally, I believe that this epidemic type of acidosis is secondary to some infection of the tonsils or nasopharynx, probably with the influenza bacillus or the streptococcus.

The usual story of a case is about as follows:

A child is taken rather suddenly with uncontrollable vomiting—it may or may not have had a slight fever with nasopharyngitis previously. There is usually no diarrhea. The skin is dry and hot, with moderate fever; the abdomen is sunken, and if the condition goes on, the eyes may be sunken, due to the loss of fluid from the vomiting, which is very severe and may be uncontrollable: usually nothing can be kept on the stomach. The urine is very scanty and highly colored, and is loaded with acetone and diacetic acid. There is likely to be excessive thirst. The lips are of a bright, cherry-red color; this is quite a striking characteristic of the condition. The respiration is deep, rapid, and labored, without cyanosis, and there is a peculiar sweetish odor to the breath—the odor of acetone. The child may be very restless or may be in a stupor.

*These children are extremely sick, their condition is a precarious one, and vigorous and prompt treatment is indicated.*

**Treatment.**—*Nursing.*—An extremely important part of the

treatment is to have a good nurse, or an intelligent, capable mother, who can be with the child; these children need to have constant attention.

*Catharsis.*—If the child can retain anything on the stomach, give it a cleaning out with calomel or castor oil; if it cannot, empty the intestine from below with a suds enema.

*Soda.*—Whether or not the child recovers depends a great deal upon whether enough alkali can be gotten into it to neutralize the acidosis and to bring back the blood to a normal alkalinity. If the urine can be made alkaline in the first twenty-four hours, the child will probably get well; if it cannot be, it may get well or may die. This is where a good nurse comes in—she must be at the child every minute to get it to take alkali. The alkali may be given by mouth, intravenously, or by rectum. You will not in most cases be able to depend upon getting it into the child by mouth, as the vomiting is so severe, but mouth administration should be tried at first. The dosage depends upon the size of the child and the severity of the acidosis, but should always be liberal. Thirty grains every two hours to a child of three years is not too much. If it has to be given by rectum, 30 drops a minute of a 10 percent solution is suitable. If it is given intravenously, a 4 percent solution is used, and the amount to be injected depends, of course, upon the size of the child.

Sodium bicarbonate should not be given subcutaneously as it causes sloughing. Do not give too much soda; there is reason in everything, and I have seen a child who died more from too much soda than from acidosis.

*Fluid.*—It is of extreme importance to get plenty of fluid into children with acidosis, to prevent them from getting dried out, and to keep the kidneys active, to remove acid from the system. They are usually very thirsty. A scanty urinary secretion is a bad sign. Fluid is best given subcutaneously in the form of normal salt solution.

*Food.*—Next in importance is food. The stomach is so irritable that it is probable that little food will be retained at first. It is useless to try to give solid food. The best food is skimmed milk, with dextrose added to 10 percent. Dextrose is indicated in acidosis in the same way it is in diabetic coma: if easily avail-

able, carbohydrate can be furnished to the body: it tends to stop the pathological breaking down of fat and acid production. Dextrose, if not well borne by the stomach, may be given intravenously in a 2 percent solution, subcutaneously in a 5 percent solution, or by rectum in a 10 percent solution.

As convalescence progresses the food should be largely carbohydrate in character, with very little fat.

*Opium.*—Opium in some form, usually morphin subcutaneously, should be given up to the limit of tolerance, as one of the most desirable things in treatment is to stop the vomiting if possible and to quiet the restlessness, which may be extreme.

*Stimulants.*—If stimulants are needed, caffein or camphor in oil may be used.

This condition is an extremely severe one, but a good deal can be done for it by prompt and thorough treatment.

## LECTURE VII

# RICKETS—SCURVY—SPASMOPHILIA

I shall speak today of three diseases of metabolism: rickets, scurvy, and spasmophilia, or tetany.

### RICKETS (RACHITIS)

**Definition.**—Rickets is a constitutional disease, probably caused mostly by prolonged error in diet, bringing about a faulty metabolism. Its chief manifestations are in the bones.

**Pathology.**—The chief lesions of rickets are in the bones. There is an overgrowth and softening of the cartilaginous layer between the epiphysis and shaft of the long bones. This area is markedly hyperemic, from the ingrowth of small blood-vessels, and the deposition of lime salts is much decreased in both the epiphyses and shafts of the bone, thus resulting in delayed ossification and *soft* bone.

The outer layers of the shaft of the bone are thick, soft, and hyperemic, with a lessened deposition of lime, and the centers of ossification in the epiphyses of the bone are in the same condition.

The essential thing to remember is that there is not enough lime deposited in the bone, and this results in a *soft* bone, which is easily distorted in shape or actually broken. Rickets may last anywhere from three to twelve months, the process in the bone going through several stages, resulting in a permanent enlargement at the epiphyses, with or without a deformed shaft.

Let it be distinctly understood that many children one sees with rachitic deformities, such as bow-legs, enlarged epiphyses, etc., have not actual rickets—the rachitic process may have entirely subsided, and what is seen is the *end-result* of the process. In many cases a child who has had severe rickets may be left with little or no deformity.

**Etiology.**—The etiology of rickets is probably due to a number of factors.

It is much more likely to be seen in artificially fed babies than in breast fed; it is most likely to be seen between the sixth and eighteenth months, but may be seen before or after this. It is much more common in the thickly populated districts of large cities than it is in the country, and negroes and Italians seem to be particularly prone to it. It is especially likely to be seen in children who have had a good many digestive troubles, who have never seemed able to do well as regards their feeding, and who have been tried first on one food, then on the other, especially the proprietary foods. The end-result of all these conditions is that not enough calcium is deposited in the bones, and this is one particular thing that the various theories of the etiology of rickets try to explain. All cases cannot be due to a lack of calcium in the food, for most babies fed on modifications of cow's milk ingest three or four times as much calcium as is actually necessary for them. It must, therefore, be due to a faulty assimilation of calcium. How can this be brought about? One way that it can certainly be brought about is by an intolerance for fat, where a large amount of the higher fatty acids are present in the intestine; the calcium in the food combines with these acids to form insoluble calcium soaps, which cannot be absorbed and are excreted in the feces, thus resulting in a great loss of calcium. Another cause is the taking of a food which contains too little calcium, as a very weak breast milk or a dilute condensed milk formula. Personally, I believe that most cases of rickets can be explained by one or the other of these errors in diet.

For practical purposes, leaving all theory aside, we can say that rickets is caused by faulty hygiene and poor nutrition.

**Symptoms and Signs.**—These are fairly characteristic, though at the outset they may be rather indefinite. The baby may be irritable, may not gain in weight, may be especially restless at night, and may sweat a good deal about the head. When the disease is developed, it is absolutely unmistakable. The head in rickets is likely to be square, with very prominent frontal bones. The anterior fontanel closes a good deal later than it should. Normally, the fontanel closes at about the nineteenth

month; in rickets, usually a good deal later. There may be soft spots in the skull, called "craniotabes." The sutures of the skull may remain open a good deal longer than usual. The dentition is usually delayed: a baby of eighteen months may have only as many teeth as a baby of eight or ten months.

The chest may be flattened laterally, giving the so-called "Harrison's grooves," a concavity of the ribs on the sides instead of a convexity. Or, in some cases, you may have seen the "pigeon-breasted" chest, with the sternum very prominent. A characteristic thing, pathognomonic of rickets, is the so-called "rosary," which is a beading of the ribs due to enlargement at the junction of the ribs and costal cartilages. These nodules may be as small as peas or as large as marbles.

The changes in the long bones also are important; there may be a great deal of bowing of the bones of the arms and also of the legs, which sometimes may be extreme in the more severe cases. The epiphyses at the wrist are usually enlarged, as are those at the ankles and knees. There may be a severe kyphosis of the spine in a good many cases. The clavicles also may be tremendously deformed. There may be in many of the long bones multiple fractures, due to the extreme softness.

**General Appearance.**—The children are usually small, poorly nourished, underdeveloped in every way. The abdomen is prominent, and the umbilicus is often everted. The spleen and liver are enlarged. These children are usually anemic, sometimes to an extreme degree, and are irritable and nervous. Laryngismus stridulus or spasmophilia may be associated with rickets.

**Diagnosis.**—The diagnosis is not at all difficult; an extreme case can hardly be mistaken for anything else. The stage of the process may be told by the appearance of the bones as shown by the $x$-ray.

**Treatment.**—The treatment of rickets consists mainly of hygiene, sunlight, fresh air, and proper feeding. More can be accomplished by this method of treatment than by any other. It is a question whether or not drugs do any good; the drugs usually given are phosphorus and cod-liver oil. I do not believe in giving the latter, because the fat digestion is usually so poor. Phosphorus may do some good, as it has been shown that

the administration of phosphorus to rachitic children favors the retention of calcium. The dose of phosphorus for a baby is $\frac{1}{120}$ grain, given from one to three times a day. It may be given in the form of pills, or as the "phosphorated oil" of the pharmacopeia, a minim of which contains about $\frac{1}{115}$ grain of phosphorus. Iron is indicated if the children are anemic, and the best preparation to use is the saccharated oxid of iron, or "Eisenzucker," as it is sometimes called. This may be given in doses of three grains three times a day to babies a year old.

The treatment of the deformities of rickets is, of course, orthopedic.

Rickets is a disease that does not in itself threaten life. The two worst things about it are that babies with rickets have very little resistance to infection, especially pulmonary infection, and that in many cases permanent deformities result from the rachitic process.

## SCURVY

Scurvy is the next subject we take up. Infantile scurvy is the same disease as scurvy in the adult. It is not the same disease as rickets, and has nothing to do with it, although years ago cases of scurvy used to be called "acute rickets." It is often associated with rickets, however, in about half the cases.

Scurvy is a food disease. It may be defined as a disease of metabolism dependent on some prolonged deficiency in the diet, the chief manifestation of which is hemorrhage, especially under the periosteum of the long bones of the leg. It is usually seen in babies from six to sixteen months of age.

A great many cases of scurvy will be found among babies fed on pasteurized or sterilized milk or on proprietary foods. It does not often develop in children fed on raw milk or on the breast. The reason probably is that the development of scurvy depends on the absence of vitamins in the diet. These are chemical substances in the milk necessary for the baby to have, but which are destroyed by heat. Therefore, the boiling of milk destroys the vitamins and predisposes to the development of scurvy. However, the etiology is not entirely clear. There are a great many contradictory features in the etiology of the

disease, for scurvy *may* develop in babies fed on raw milk or on breast milk.

A number of years ago the American Pediatric Society investigated a large series of cases of scurvy, with special regard to the etiology, and the only definite conclusion that they could arrive at was that the more a food differs from a baby's natural food, breast milk, the more likely is its use to be followed by scurvy.

A tabulation of the cases they investigated is as follows:

| | | | | |
|---|---|---|---|---|
| 12 | cases | fed | on | breast milk. |
| 5 | " | " | " | raw cow's milk. |
| 20 | " | " | " | pasteurized milk. |
| 60 | " | " | " | condensed milk. |
| 107 | " | " | " | sterilized milk. |
| 214 | " | " | " | proprietary infant foods. |

You can see from this that scurvy *may* develop in a baby fed on any sort of milk, but that it is much more likely to be seen in babies who have been fed on sterilized milk or on one of the proprietary foods. We do not need to go into the etiology of scurvy any further; it is enough for our purposes to say that it is probably caused in most cases by feeding a baby on a prolonged diet which lacks some element or elements necessary for its proper nutrition: that these elements probably are "vitamins" and are destroyed by heat, which explains why babies are so much more likely to develop scurvy when they are fed on sterilized rather than on raw milk.

**Pathology.**—The most prominent feature in the pathology of scurvy is the tendency to hemorrhage. This hemorrhage occurs especially under the periosteum of the bones, and is much more often seen in the bones of the lower extremities than in any other location. Sometimes the hemorrhage may be very large, and may cause tremendous swelling of the legs; the clotted or partly organized blood may feel very hard, and may sometimes be mistaken for a bony tumor. Although there may be considerable hemorrhage under the periosteum adjacent to a joint, the joints themselves are but very rarely affected. There may be hemorrhage from the kidneys, or more rarely into the skin, into the intestine, or back of the eyeball. A hemorrhagic condition of the gums, especially the upper gums, is common.

**Symptoms.**—The symptoms of scurvy are fairly characteristic. The onset is usually gradual, and the first symptom is likely to be tenderness of the legs. The usual story is about this: a baby who has been previously well, and who perhaps has been walking about, becomes fretful and irritable, stops walking, and cries when its legs are moved or touched. In many early cases these may be the only symptoms, and slight as these symptoms may seem, *they are enough upon which to make a positive diagnosis of scurvy, provided other conditions are ruled out.* There may be a great deal of swelling of the legs, and they are usually extremely tender, the slightest touch causing the baby severe pain. The position these babies lie in is characteristic, with outward rotation of the thighs and eversion of the feet. The appearance of the gums is characteristic: in babies who have teeth the gums around the teeth, especially the upper ones, are swollen, soft, dark reddish purple in color, and bleed very easily. Blood may occur in the urine in some cases—sometimes it may be the first symptom: the urine may be bright red, or it may be recognized by microscopic examination. If a small baby has blood in its urine, scurvy should always be considered. The pain, the tenderness and swelling of the legs, the purple, swollen gums, and the hematuria are the most important points in the diagnosis of scurvy. Of these, pain in the legs is the most important symptom. All these signs may not occur together, but when they do, the diagnosis of scurvy is very easy to make.

Rarely there may be hemorrhages into the skin and into the intestine, or in the orbit, causing a protrusion of the eyeball, but these are not the ordinary signs to be looked for.

There is usually no particular digestive disturbance with scurvy. There may be fever, in most cases not very high.

**Prognosis.**—If the case is not treated and lingers on for several months, the child will finally die from toxemia and malnutrition; if it is treated right, it will be well in a few days.

**Diagnosis.**—There are a number of things from which scurvy must be differentiated. One of the most common mistakes is to call scurvy acute rheumatism. These points should help in the diagnosis. Acute rheumatism is excessively rare in children under two or three years old; in scurvy the other signs,

sponginess of the gums, etc., are likely to be present, and the swelling and tenderness are especially in the *shaft* of the bone, and not around the joint, as they would be in rheumatism.

Sometimes scurvy may be mistaken for poliomyelitis or infantile paralysis, on account of the pseudoparalysis of the legs, but usually in infantile paralysis there is not nearly so much tenderness, and the knee-jerks are not absent in scurvy as in infantile paralysis. Also, there is no swelling of the legs in infantile paralysis.

Occasionally, the severe epiphysitis sometimes seen in cases of congenital syphilis will be confused with scurvy, but usually there are other signs of syphilis present, such as the skin lesions, enlarged spleen, etc., which will aid in the diagnosis.

I don't think there is any doubt but that a great many cases of scurvy are overlooked. The tenderness of the legs is enough to suggest a diagnosis in a great many cases, even if there are no other signs or symptoms present.

**Treatment.**—The proper treatment of scurvy is important and it is a very satisfactory treatment. There are few diseases that will respond to treatment so well as scurvy does. It is remarkable what can be done for a child who is treated properly. The treatment is to give him fresh fruit-juice or fresh vegetables. The best fruit to use is orange. If oranges cannot be obtained, use scraped potato or scraped apple. Fruit-juices are better than vegetable juices. Give the orange-juice in tablespoonful doses about an hour before the feeding—four doses a day. The idea of the treatment is to supply the missing vitamins by giving fruit or vegetable juices, which contain these substances. The peculiar thing is that the vitamins in orange-juice or vegetable juice cannot be destroyed by cooking, as the vitamins in milk can, so mashed potato is a fairly satisfactory antiscorbutic. Most cases of scurvy can be cured in about a week or ten days; many cases in three or four days. In treating a child who has scurvy do not have his milk pasteurized or sterilized if you can get good milk. When a child is being fed on sterilized or pasteurized milk or on proprietary foods, it is better to give it small doses of orange-juice right along, because it acts as a prophylactic and prevents the development of scurvy.

It is interesting to note what Thomas Sydenham, the great English physician, writing about 1660, considered his favorite prescription for scurvy. He says: "The patient ought to use the following medicated beer for common drink:

"Take of the root of horseradish, fresh gathered, two drachms; twelve leaves of scurvy grass, six raisins stoned, and half a Seville orange; bruise and slice the ingredients, and infuse them in a large glass vessel, well corked, in a quart of small beer.

"Let six bottles of this beer be made at one time, and in a few days, before it be finished, six more, and renew them for the future in the same manner."

## SPASMOPHILIA (TETANY)

Spasmophilia, or tetany, is a condition caused by a disturbance of metabolism, probably connected in some way with the calcium metabolism. It may occur in adults or in children of any age, but it is most common in bottle-fed babies from six months to two years of age. It is rare in breast-fed babies. It is manifested by extreme nervous irritability with tonic muscular spasms, especially of the hands and feet, with or without general convulsions. It is not the same thing as *tetanus*, and bears no relation whatsoever to it. It is frequently associated with rickets.

**Etiology.**—In adults tetany may be caused by removal of the parathyroid glands, minute bodies, four to six in number, which lie near the thyroid gland. In the tetany of babies there may sometimes be found small hemorrhages into the parathyroid glands at autopsy, but it has never been clearly shown just what connection the parathyroids have with it, and it is probable that they have little to do with the ordinary spasmophilia seen in small babies.

A great deal of experimental work has been done with tetany in the last few years, and various theories have been advanced to explain it. The most reasonable explanation I have ever seen is one advanced by Drs. Brown and Fletcher, of Toronto, about a year ago, based on a considerable number of investigations conducted by them.

In the body, to preserve the proper nerve equilibrium, there must be present, on the one hand, calcium and magnesium, on the other hand, sodium and potassium, in fairly constant ratio. Calcium and magnesium are nerve sedatives; sodium and potassium are nerve excitants. The idea is that spasmophilia is due to an abnormal storing up of sodium and potassium in the body, in excess of the calcium and magnesium, with a resulting hyperirritability of the nervous system.

This theory is borne out by many chemical data which I do not need to go into.

Spasmophilia almost always occurs during the winter months: rarely, in the summer. This theory explains the seasonal occurrence by the fact that babies are very likely to have diarrhea during the summer, with a resulting *loss* of sodium and potassium, for it is well known that in the ordinary acid diarrhea due to sugar fermentation there may be a considerable loss of these elements. Thus, in the summer there is no chance for the storing up of sodium and potassium, and so no spasmophilia, whereas in the winter months, when babies are not so likely to have loose bowels, there is more chance for the storing up of these elements, and consequently more spasmophilia. This is borne out by clinical experience, for it is well known that constipated babies are more likely to develop spasmophilia than are those who have a tendency to looseness of the bowels. So much for the theory.

**Diagnosis.**—Spasmophilia is not at all an uncommon condition, and is easy of diagnosis if one has seen previous cases and is on the watch for it—if one is not, it may be very easily overlooked.

The chief characteristic of the condition is a nervous hyperirritability. This is manifested by peculiar spasms involving especially the hands and feet. Another manifestation of the condition is "laryngismus stridulus." The spasms of tetany are quite characteristic: the hands and feet are held in positions peculiar to the disease.

The wrists are flexed; the hand has a tendency to be drawn to the ulnar side; the fingers are partially flexed at the metacarpophalangeal joints, and the thumb is drawn over across the palm of the hand toward the little finger. The feet are

extended on the leg as far as possible, and the toes are flexed on the foot. A description of these positions brings little to the mind, but when once a typical "carpopedal" spasm, as it is called, has been seen, it will never be forgotten.

In some of the cases there will be generalized convulsions; in others, only the carpopedal spasm. The spasms may occur a few times a day or be nearly continuous. The carpopedal spasm is practically always *bilateral*. The duration of a spasm varies a good deal: ten or fifteen minutes is a fair average. A good deal of pain may be associated with the spasm, especially if one tries to unclinch the fingers of the baby's hand.

An attack of tetany may usually be diagnosed by the characteristic position of the hands and feet during a spasm, but there are three other signs which are of importance:

*Chvostek's Sign.*—This consists of a quick contraction of the muscles of the face, especially of the mouth muscles, when the facial nerve is lightly tapped. This occurs in children with spasmophilia, but *not* in normal children.

*Trousseau's Symptom.*—If the upper arm of a baby with spasmophilia is squeezed so as to compress the large nerve-trunks for a few moments, a typical carpopedal spasm results.

*The Electrical Reactions.*—This is the most scientific and accurate way of diagnosing spasmophilia, but is hardly practical for general use. The muscles in babies with spasmophilia require much less electricity to be applied to them to cause a contraction than do the muscles of a normal baby. By one familiar with the method the exact amount of electricity necessary to cause the contraction of a muscle can be determined; if this amount is less than the normal, the baby probably has spasmophilia.

The characteristic electrical reactions always occur in cases of spasmophilia—Chvostek's and Trousseau's signs may or may not. Of these last two signs, Chvostek's is the more valuable.

**Prognosis.**—Spasmophilia untreated may last indefinitely. Mild spasmophilia may last only a week or two. It is not dangerous to life unless severe general convulsions develop. Properly treated, it can usually be controlled readily in a few weeks at the most.

**Treatment.**—The treatment may be divided into two parts: the treatment of the attack and the subsequent treatment in order to prevent further attacks.

*Treatment of the Attack.*—The treatment is the same as for an ordinary convulsion. Give the baby a large dose of castor oil to get the bowels cleaned out; get him into a hot tub, and give him sodium bromid and chloral by rectum, or anesthetize with chloroform if you prefer. Sodium bromid and chloral can usually be given in large doses to children by rectum: 5 grains of chloral and 10 of sodium bromid is not too much to give to a child a year and a half old. It is best given in a little warm milk.

I never like to give morphin to babies or children if there is any other drug that can be used, for some of them bear it very poorly.

*Subsequent Treatment.*—If the baby is a bottle-fed baby, as it most surely will be, get breast milk for it, if possible. Many times the mere substitution of breast for bottle milk will relieve the condition without any other treatment. If breast milk cannot be obtained, feed the baby a milk as high in its calcium content as possible by using a milk to which precipitated casein has been added, as there is a good deal of calcium in precipitated casein. See that the baby has several free movements of the bowels a day, and be sure that it gets plenty of water between feedings, in order to keep the kidneys active. I believe this to be of very great importance—*keep the kidneys active.*

*Drugs.*—A number of drugs have been used in treating spasmophilia. Extract of parathyroid gland has been given, with very small success, and it is probable that this is of little or no value in the treatment of the infantile type of tetany, at any rate.

The drugs which are of value are the salts of calcium and magnesium. Calcium lactate may be given in large doses—the dosage depends mostly on the results which are obtained with it: if good results do not follow its use, use more. Five grains every three hours is a safe dose to start with for a baby a year old: it may be increased if necessary.

Calcium chlorid may be used in the same way and is said by some pediatricians who have had a great deal of experience with spasmophilia to be of more value than the lactate.

Run the dosage of this up until it has some effect in diminishing the spasms or the child's stomach is upset. The great trouble with calcium chlorid is that it is very irritating to the stomach.

Subcutaneous injections have been used by some pediatricians in the treatment of tetany, with considerable success. An 8 percent sterile solution of magnesium sulphate is used, and 0.2 gram of the salt is given for each kilogram of body weight of the baby, 15 to 20 c.c. being injected at a time.

I merely mention this method of treatment as I have had no experience with it myself.

The use of calcium salts in the treatment of spasmophilia is a very rational procedure: there is much clinical evidence to support it. It has also been shown experimentally that the intravenous injection of calcium will almost immediately control spasms of tetany in dogs who have been given the condition by extirpation of the parathyroids. Spasmophilia is a condition which I am sure you will see here if you are on the lookout for it, and with proper treatment good results can be obtained in dealing with it.

## CLINICS

### CASE I.—VOMITING FROM IRREGULAR FEEDING

A breast-fed baby (male) one month old.

**Family History.**—Two more healthy children, whom the mother nursed, and who did very well on her breast milk. Otherwise not remarkable.

**Past History.**—Full-term normal delivery; birth weight unknown. Breast fed any time he cries; no regularity of any sort in the feeding: sometimes the feeding intervals are half an hour apart; sometimes three hours.

**Present Complaint.**—At birth the baby was deeply jaundiced (probably icterus neonatorum and of no significance).

Since birth he has vomited after nearly every feeding, usually immediately after feeding. Sometimes he vomits a large amount, but generally not a great deal. There are no tough curds in the vomitus, and it is rather thick and creamy in consistence. Occasionally the vomiting is explosive in character, but this is by no means constant, occurring perhaps once a day. The baby has no colic, and seems well and healthy except for the vomiting. His movements are inclined to be constipated, but are of fair size: usually one or two a day. He nurses from ten to fifteen minutes at a time, and his mother keeps him reasonably quiet after the nursing.

**Physical Examination.**—The general condition of this baby is good. He lies quietly in his mother's lap, is bright and active, and does not seem to have lost much weight. His color is good. The physical examination is entirely negative; there is no tumor to be felt in the abdomen, and no peristalsis to be seen. A stool examination would be of value, but the mother has brought no stool.

**Discussion.**—A number of things may be considered in getting at the cause of this baby's vomiting.

1. *Pyloric Stenosis or Spasm.*—It is very unlikely that he has pyloric spasm, as this is rare in breast-fed babies and is not

likely to show itself so soon after birth. It is also unlikely that this baby has pyloric stenosis; his general condition is too good, and it is plain that a good deal of food is getting into his intestine, because he is in a state of reasonably good nutrition and has large stools.

The most probable cause of his vomiting is too much rich breast milk fed to him at irregular intervals. The mother has full breasts, with a good deal of milk, which she says seems to be very rich in quality. The baby is fed at any time, so his stomach is often distended, causing him to vomit. If the milk is high in fat, as it seems to be, this would also tend to cause him to vomit, and would also possibly account partly for his constipated stools.

It is within the bounds of possibility, but is not at all probable, that this mother's milk may never be suitable for this baby, although it may be found upon chemical examination to be apparently perfectly normal in composition. You will occasionally see a case in which the breast milk seems to contain some toxic material that continually upsets the baby, but never assume that any case is of this type until you have ruled out all other causes of vomiting. I would treat this baby as follows:

Have him fed regularly at three-hour intervals, and let him nurse only ten minutes at a time, and I believe it very probable that his vomiting will soon disappear under these conditions of feeding. If it does not improve after a thorough trial, it will be well to give him a couple of tablespoonfuls of lime-water before each breast feeding, and still if it does not improve, substitute a weak cow's milk modification for three of the breast feedings; if he vomits the weak artificial feedings, after thorough trial, as much as he does the breast feedings, it is likely that he has a mild pyloric stenosis. If he does not vomit the cow's milk feedings and continues to vomit the breast feedings, have the breast milk analyzed, and if it is of unfavorable composition, try to modify it by the methods I suggested in the lecture on breast feeding.

As a last and most remote possibility: if he still continues to vomit all the breast milk he takes and to keep down his bottle feedings, take him off the breast. I believe the prognosis to be

perfectly good for this baby, and that his vomiting can be controlled simply by regulating the time and amount of his feedings.

### CASE II.—INDIGESTION FROM NERVOUS INFLUENCES

A breast-fed baby (female) three weeks old.

**Family History.**—The second child of healthy but very nervous and highly strung parents. The first child is two years old, very nervous, and subject to violent fits of temper. Otherwise well.

**Past History.**—Born at term after a normal delivery. Birth weight, 8 pounds. Breast fed every two hours.

**Present Complaint.**—The child has been very fretful and irritable for the past week, crying most of the time, and apparently having a good deal of colic, especially at night. She does not vomit, but has had a good deal of diarrhea, having usually eight to ten very loose stools a day, which look fairly normal except for the decreased consistence. She seems so uncomfortable at night, and cries so much that the family get very little rest. She takes the breast well, usually nursing for about fifteen minutes. She weighs eight pounds two ounces; practically no gain since birth.

The state of the household is of considerable importance in this case; it is in a good deal of confusion. The nurse of the other child left about a week ago, as did also the cook, so things have not been running very smoothly and the mother is worried and nervous.

**Physical Examination.**—Nothing abnormal is found on physical examination of the baby, and she seems to be in a very fair state of nutrition.

**Treatment.**—The thing of most importance to be done first in this case was to get the household straightened out, especially to relieve the mother of all care of the other child; and this was done. The grandmother, who was an extremely capable and sensible woman, came and took hold of things—took charge of the other child, and relieved the mother of all household responsibility. This is extremely important: *a nursing mother cannot nurse her baby satisfactorily if she has worries on her mind.*

It seemed best in this particular case to give, only temporarily, however, a few bottle feedings to the baby, partly to rest the mother and partly to rest the baby's intestines, as it seemed likely that the breast milk was too rich. The mother was directed to feed the baby as follows:

6.00 A. M.: Breast.
8.30 A. M.: Breast.
11.00 A. M.: Bottle.
1.30 P. M.: Breast.
4.00 P. M.: Bottle.
6.30 P. M.: Breast.
9.00 P. M.: Bottle.
2.00 A. M.: Breast.

These three bottle feedings were arranged in such a way that the mother had a chance to get outdoors in the morning and afternoon for exercise and a change of surroundings. The modification given was the following:

Fat 1 percent Sugar 5 percent Protein 1.2 percent
Lime-water ⅓ milk and cream.

Two ounces were given at each feeding. This was made up as follows:

| | |
|---|---|
| 16 percent cream | ½ ounce |
| Skimmed milk | 2½ ounces |
| Lime-water | 1 ounce |
| Water | 4 ounces |
| Milk-sugar | 1 scant tablespoonful |

A sample of the mother's breast milk was taken at this time and sent away for analysis. The baby was seen one week later, and was found to be doing very well. The irritability and colic had improved a good deal, and the stools were fewer in number —six or seven a day instead of nine or ten, as before, but were still diminished in consistence. She took the bottle milk well, and was not upset by it. The report of the composition of the mother's milk came back as follows:

Fat 3.8 percent Sugar 6.9 percent Protein 3 percent

This was a reasonable composition, except for the very high protein percentage, which probably had something to do

with upsetting the baby. The treatment at this visit was to increase the length of the feeding intervals to three hours, thus giving the baby seven feedings in the twenty-four hours—four breast and three bottle. The fat percentage in the bottle milk was raised to 2 and the sugar percentage to 6 percent and the mother was instructed to eat meat or fish only once a day, in the hope of perhaps bringing down the protein percentage in her milk.

One week later the baby was found to be doing very well; she slept nearly all night, had only three or four nearly normal stools a day, and had gained seven ounces. This time the treatment was to omit two of the bottle feedings, substituting breast feedings for them, thus giving the baby the following feeding schedule:

| | |
|---|---|
| 6.00 A. M.: | Breast. |
| 9.00 A. M.: | Breast. |
| 12.00 M.: | Breast. |
| 3.00 P. M.: | Bottle. |
| 6.00 P. M.. | Breast. |
| 9.00 P. M.: | Breast. |
| Night: | Breast. |

The baby was seen twice afterward, and continued to do well under this régime, gaining from six to nine ounces each week.

**Discussion.**—This is a common type of case. Fully as important as the feeding, and perhaps more so, is it to get the household straightened out and relieve the mother of all worry, if possible. In this particular case it seemed best to give a few bottle feedings temporarily, and it worked out well, but in many cases this would not be advisable. Of course, it would be absolutely wrong to wean the baby in such a case as this, nor would it be advisable to take her entirely off the breast, even temporarily.

Many babies of this type do much better on three-hour feeding intervals than on two- or two-and-one-half-hour intervals, and this baby did. In many cases no other treatment will be found necessary than to increase the length of the feeding interval. This baby was left permanently on one bottle feeding a day in order to give the mother a chance to get out and to get the baby used to taking the bottle, as in all probability this

particular woman will not be able to nurse her baby more than six or seven months. The strength and amount of this bottle feeding must, of course, be gradually raised as the baby gets older.

### CASE III.—A BABY WITH OBSTINATE VOMITING CAUSED BY TAKING HIS MILK TOO QUICKLY—CONDENSED MILK BABIES

H. W., male, seven months old, is brought on account of vomiting and malnutrition.

**Family History.**—Unimportant. The second child of healthy parents. No tuberculosis in the family. No miscarriages.

**Past History.**—Full term, normal delivery. Birth weight not known; weight at one month, 7½ pounds.

He has always been fed on a bottle, with various modifications of condensed milk, up to two weeks ago, when the present feeding was started. He seemed to digest the condensed milk well, but was always hungry, and his mother thinks there has been no gain of weight for the last three months. Two weeks ago Dr. B. was called in because the baby was not gaining, and he put him on the following formula:

| | |
|---|---|
| Skimmed milk | 24 ounces |
| Lime-water | 12 " |
| Milk-sugar | 2 " |
| Barley water | 12 " |
| Six feedings of 8 ounces | |

Fat 0.0 to 0.5 percent Sugar 6.25 percent Protein 1.6 percent
Starch, about 0.4 percent

**Present Complaint.**—The child has not seemed to do well on this feeding; he will take only six ounces of it at a time, and he vomits after nearly every feeding, so that his mother judges that he retains only about half his food. The vomitus does *not* contain tough curds, nor do the stools. He is ravenously hungry, and takes his bottle of six ounces in about three minutes. His stools are loose and green, with small white curds, sour smelling—about four to ten a day. It should be said that these stools had been this way for about a month before he was put on his present feeding, when he was taking the condensed milk modification.

**Physical Examination.**—The striking thing about him is that he does not look *sick*. His particular characteristic is that he is *small;* he looks like a moderately well-nourished baby of three or four months, instead of one of seven months. He is happy and active, and at a casual glance you never would pick out this baby as one who vomits nearly half what he eats, and has a severe diarrhea, as his mother says he has. It is rather surprising that he looks in such good condition, but as you feel of him you see that his good condition is apparent rather than real; his skin is loose and his flesh is very flabby and soft. He has no teeth. There is nothing else noteworthy about the physical examination. He has no signs of rickets.

**Discussion.**—This baby is one of the types of condensed milk babies. Condensed milk sometimes is of value to feed a baby on temporarily, but it should never be used as a permanent diet; if it is, bad results are sure to follow, the reason for this being that condensed milk is not a *well-balanced* food, consisting almost entirely of cane-sugar. Speaking very generally, three types of condensed milk babies are likely to be seen, as follows:

1. A much undernourished baby, thin, and with rickets.

2. A large, fat baby, who upon superficial examination may appear fairly healthy, but who is seen upon closer examination to be anemic and to have very flabby, soft flesh.

3. A *small* baby, underdeveloped, of fair nutrition, but soft and flabby. It is to this last class that this particular baby belongs.

What are the problems to consider in the case of this baby?

1. To give him a food upon which he can gain weight and develop normally.

2. To consider the cause of his diarrhea, and to stop it if we can.

3. Why does he vomit, and what is the best way to stop it?

His diarrhea is probably due to the fact that he has been fed on a very high sugar diet (condensed milk) over a long period of time. This sugar has fermented in the intestines, with the formation of volatile fatty acids, such as acetic, butyric, etc. These have irritated the intestine and given rise to an increased intestinal peristalsis and diarrhea. There is probably also a

secondary fermentation of what little fat there is present, and a much decreased absorption of all the food elements, due partly to increased peristalsis and partly to the abnormally acid condition in the intestine. The digestion is weak for all the food elements, especially for fat, as this baby has been fed on a food which contains very little fat, so his fat digestion probably remains undeveloped. The indications are for a food low in fat and low in sugar, the sugar used being dextri-maltose instead of lactose or sucrose, as it ferments less readily. He can also take a little starch, and can probably be fed on a fairly high percentage of protein. We will discuss this feeding in more detail later.

As to his vomiting: He is certainly not vomiting from an excess of fat, as he is on skimmed milk, and the mother seems to be skimming it carefully. It is also rather unreasonable to suppose that he is vomiting from protein indigestion, as the protein percentage in his milk is not high, there are no tough curds in his vomitus or in his stools, and the lime-water in the mixture equals 50 percent of the milk and cream, which would certainly prevent the formation of any tough curds in the stomach, and vomiting from this cause.

There are two things that may cause vomiting in a baby, which are often overlooked, because they are so simple:

1. A too freely running nipple, which makes him fill his stomach too quickly, and probably also gulp down a good deal of air with his milk.

2. Shaking of the baby by his mother after he has eaten, to keep him quiet. A baby's stomach is placed much more vertically than an adult's is, and the esophagus is relatively shorter and wider, so that any movement when his stomach is full is very likely to make him vomit. A baby should always be laid quietly in his crib for at least half an hour after he has eaten.

Now this baby, so his mother says, emptied his six-ounce bottle in three minutes; he should take about fifteen minutes. Let us look at the nipple. You see here is a nipple with *three* large holes in it, and when the bottle is inverted, the milk runs out in a steady stream, making a very *fast* nipple. This nipple is probably the principal cause of the baby's vomiting. Let us tell the mother to get a new nipple without any hole in it, to

take a small needle, heat it red hot, and make a hole through the nipple with it through which the milk will *slowly* come drop by drop, and use this instead of the nipples she has been using. Also have her stop shaking the baby up after his bottle; have her keep him absolutely quiet for half an hour after each feeding.

As to the details of feeding: six ounces at a feeding seem to be about all this baby will stand at the present time, so let us give him six ounces every three hours, seven feedings a day, at the following times:

6.00 A. M.
9.00 A. M.
12.00 M.
3.00 P. M.
6.00 P. M.
9.00 P. M.
2.00 A. M.

The formula that he is on at present is a reasonable formula for him except that we need to cut down the sugar percentage and substitute a malt-sugar (dextri-maltose) for the lactose he is now taking. So let us give him:

| | |
|---|---|
| Skimmed milk | 24 ounces |
| Lime-water | 12 " |
| Barley water | 12 " |
| Dextri-maltose | 1 level teaspoonful |

giving a percentage of—

| | | |
|---|---|---|
| Fat 0.0 to 0.5 percent | Sugar 3.05 percent<br>Starch 0.4 percent | Protein 1.6 percent |

Of course, such a food as this is far below his caloric requirements, and he will not gain weight on it, but we must first get his vomiting and his diarrhea straightened out before we can hope to make him gain. He should probably improve a good deal in a few days, and as he improves his milk can be gradually strengthened, but the fat and sugar will probably have to be kept fairly low for some time. I should think, in the course of two weeks, that we might expect to have this baby on some such formula as this:

Fat 2.5 percent    Sugar 5 percent    Protein 2.4 percent    Starch 0.75 percent

and that he would be taking seven ounces at a feeding instead of six. Do not increase the strength and the *amount* of a formula at the same time; it is better usually first to increase the strength and then the amount.

What points may be brought out from a study of this case?

1. Condensed milk is an unsuitable food for a baby to take over any considerable period of time; it gets him into trouble sooner or later. Condensed milk is very likely to give a baby a sugar diarrhea and a weak digestion for fat.

2. Such simple things as big holes in nipples and shaking up after feeding may cause severe vomiting; it is not always necessary to go into chemistry and science to explain vomiting.

### CASE IV.—CHRONIC SUGAR AND FAT INDIGESTION

E. R., female, aged five months, is brought to the clinic on account of failure to gain.

**Family History.**—The only child of healthy parents. No tuberculosis in the family. No miscarriages.

**Past History.**—Born at full term after a normal delivery. The birth weight is said to have been ten pounds, but this is doubtful. Breast fed for five weeks, when the breast milk gave out. From this time up to a week ago she had been fed on various combinations of several different proprietary foods and condensed milks, *all of which contained a very high percentage of carbohydrate.* For a week she has been taking the following mixture:

| | |
|---|---|
| Skimmed milk | 8 ounces |
| Lime-water | 3 " |
| Milk-sugar | 3 rounded tablespoons |
| Water to make | 32 ounces |

Four ounces every three hours.

This gives a percentage composition of—

| | | |
|---|---|---|
| Fat 0.0 to 0.5 percent | Sugar 5.6 percent | Protein 0.8 percent |

The chief trouble with the baby is failure to gain weight and looseness of the bowels. She takes her milk well and never vomits, but loses weight steadily, and has daily at least four or five rather loose yellowish stools of about the consistence of

scrambled eggs. These stools smell strongly acid and have many small, soft white curds scattered through them.

**Physical Examination.**—A very small, poorly developed and nourished baby. The skin is loose and dry, showing evidence of a considerable loss of weight. Weight, seven pounds. The chest is very small; the abdomen is prominent, and apparently out of all proportion to the rest of the body. There is slight general glandular enlargement. The buttocks are red and irritated. There is nothing else of interest about the physical examination.

**Stool Examination.**—The stool is soft, loose, yellow in color, with many small curds. The smell is strongly acid, as is the reaction to litmus. Microscopically there is a large excess of fat in the form of fatty acids and soap. This would seem not consistent with the skimmed milk diet, but can be explained by the fact that the mother is not skimming the milk properly.

**Discussion and Treatment.**—This is one of the most common types of indigestion seen in infants under a year old. It is a combination of fat and sugar indigestion. The baby has been fed always on a food high in carbohydrate, and chronic sugar indigestion has resulted. The exact mechanism of the fat indigestion is not well understood, but it is certain that in this type of case sugar indigestion does not represent the whole story by any means, and that fat indigestion, or failure of fat absorption, more properly speaking, plays fully as important a rôle as does the sugar indigestion. Which of the two is primary it is hard to tell—probably the sugar. The stools that this baby has are very characteristic of the condition, and are so strongly acid that they have excoriated the buttocks. The treatment is difficult—one of the most difficult problems in infant feeding.

**Principles of Treatment.**—These babies always do best on a food low in fat and sugar and high in protein in an easily assimilable form. In most cases, but not in all, a malt-sugar preparation is tolerated better than milk-sugar. The principle of feeding is the same as for fermentative diarrhea: to change the reaction of the intestine from strongly acid to faintly acid, neutral, or faintly alkaline by feeding to the baby a high protein

and a low fat and sugar food, the end-products of which will be alkaline.

If we feed a baby of this type from a milk laboratory, the problem is comparatively simple: we write a prescription for so much fat, sugar, and protein in the milk, and it is delivered at the door next morning all made up. In feeding cases of this type from a milk laboratory I nearly always use a mixture containing a low percentage of fat and malt-sugar and a high percentage of protein in the form of precipitated casein. Sometimes I use olive oil in place of the milk-fat; in these cases the whole mixture is run through the homogenizing machine, thus making a very easily digested preparation, as the protein is in the form of precipitated casein and cannot coagulate in the stomach, and the fat-globules have been broken up so finely by the homogenization that their digestion and absorption are very easy. If a milk laboratory is not available, the next best food upon which to feed these cases is Finkelstein's "Eiweiss" milk. Very good results are often obtained with this.

**Details of Treatment.**—Finkelstein's "Eiweiss" milk, you remember, is made up as follows: Heat one quart of whole milk to 100° F. Add four tablespoons of essence of pepsin and stir. Let it stand at 100° F. until a curd has formed, and strain off the whey from the curd. Press the curd through a fine sieve three or four times. Add one pint of water to the curd and one pint of buttermilk to this mixture. This gives a food containing—

| | | |
|---|---|---|
| Fat 2.5 percent | Sugar 1.5 percent | Protein 3 percent |

So let us put this baby on "Eiweiss" milk, giving eight feedings of four ounces each to start with. Later the amount can be increased. It will be better, also, at first to have the mother make the curds from skimmed milk instead of whole milk, as this baby's fat tolerance is low, and she will probably do better on a food containing very little fat. Later we can raise the fat percentage. She will probably need to be kept on "Eiweiss" milk for several weeks. After several days, if her movements become better and tend more to the alkaline reaction, malt-sugar may be added to 3 or 4 percent. After four or five weeks the "Eiweiss" milk may be gradually discon-

tinued and she can be put on a skimmed-milk and gravity cream modification, with a rather low fat and sugar and a higher protein percentage.

You will say that such a method of milk preparation is too complicated for many people to carry out. This is true; it *is* a rather complicated method, but with such a baby as this it is impossible to obtain satisfactory results with simple milk and water dilutions. Neglected babies of this type have practically no chance of surviving; properly treated, most of them do very well.

## CASE V.—THE FEEDING OF AN EIGHTEEN-MONTHS-OLD BABY WITH CHRONIC FERMENTATIVE DIARRHEA

W. L., male, eighteen months, is brought on account of diarrhea.

**Family History.**—Not remarkable. The only child of healthy parents. No tuberculosis in the family. No miscarriages.

**Past History.**—Full-term, normal delivery. Birth weight unknown. He was breast fed ten months and then was put on whole milk, cereals, bread, and potato. He has always been well, although not particularly rugged, until the onset of his present complaint four weeks ago.

**Present Complaint.**—For nearly four weeks he has had diarrhea—from seven to ten loose green stools, containing mucus, a day. These stools have contained a good many small white curds, but there has been at no time any blood present. He has had a little fever at night occasionally,—from 100.5° to 101.5° F.,—but has had a good appetite, not seeming particularly sick. He has never been weighed, but his mother thinks he has lost a good deal during the last four weeks. At present he is taking skimmed milk and barley water, equal parts, eight ounces, six times a day. In the last few days his stools have been a little better, but he still passes five or six a day; they are very loose, slightly green, and contain many fine white curds.

**Physical Examination.**—As we look at this baby we can see that his general appearance indicates that he has lost a good deal of weight, but still that he is not yet in the "atrophic" stage. He is pale, with dark circles beneath his eyes; his flesh is very flabby and his skin loose. He has probably lost from four to

five pounds in the last few weeks. His abdomen is prominent and lax; his liver is felt about 4 cm. below the costal margin. There is nothing else of interest about the physical examination. He has no evidences of rickets.

**Discussion.**—This child has probably had a fermentative diarrhea, due to carbohydrate fermentation, from which he is slowly recovering. The fact that he at no time had blood in his stools, that he did not seem particularly sick, and that he had very little temperature, would rule out infectious diarrhea. We know that his diarrhea is due to fermentation of carbohydrate because the stools are acid in reaction and green in color. He has never been fed a particularly high carbohydrate food, so we can assume that his trouble came in the beginning from milk probably infected with the Bacillus proteus, the colon bacillus, or one of the numerous other microörganisms that may cause fermentative diarrhea. He has been treated reasonably and well, and has improved somewhat, but not nearly so fast as he should have done. What is the reason for this? Let us inquire into the particulars of the milk he is taking and its mode of preparation.

We find that the milk he is taking comes from a Jersey cow owned by his father; that it is skimmed after standing only two hours, and that it is not boiled.

When we examine his stool microscopically we find that it consists almost entirely of *soap*, although it is supposed that he is being fed on a milk free from fat. This means that the milk is not being properly skimmed, and as it is a rich milk from a Jersey cow, this child is probably getting at least 2 percent of fat in his diet, when he should have none. It is of great importance to keep the fat low in this case, and this is why he has not improved more rapidly. This is a very important point—you may *think* you are feeding a skimmed milk sometimes, but are not at all, because the milk may be very rich milk to start with, and is not being skimmed properly. You will see a great many cases like this. Let us tell this mother not to skim the milk until it has stood six hours, and then to get all the cream off that she can. Of course, it is impossible to obtain an absolutely fat-free milk by hand skimming, but it is probable that the fat can be reduced to 0.5 percent or less.

Also, we will tell her to boil the milk five minutes; this is important. The weather is very hot at present, and milk spoils quickly in this climate if it is not boiled, and it is probable that contaminated milk was the cause of this child's trouble to begin with, so let us boil his milk ten minutes. If you feed a child for any length of time on boiled milk, it is best to give him orange-juice, to prevent the development of scurvy, but we shall not start giving orange-juice to this particular baby until his diarrhea has cleared up. Let us give him this modification:

| | |
|---|---|
| Skimmed milk | 24 ounces |
| Barley water | 24 " |

Six feedings of eight ounces each.

This mixture has the following composition:

| | | |
|---|---|---|
| Fat 0.0 percent | Sugar 2.25 percent<br>Starch 0.75 percent | Protein 1.6 percent |

This, of course, is a very weak milk for this baby, but we must feed him on a weak milk for a few days, as he is at present unable to digest a stronger one. We shall see him again next week. Weight at present, 20 pounds. He probably will do well, but will gain weight slowly.

*July 5th.*—He is taking his milk well and is having two or three small stools a day—slightly acid, yellowish, no excess of fat microscopically. Weight, 19½ pounds. It is safe to raise his feeding a little, so we can give him now 48 ounces of undiluted skimmed milk, with the addition of four tablespoonfuls of dextri-maltose, giving a sugar percentage of 7.7, which is a fairly high sugar percentage to feed to a baby such as this; but he is in such good condition that he will probably stand it. If, after a day or two of this feeding, he has no trouble, we will tell his mother to give him four tablespoons of barley jelly a day. It is best to have his milk skimmed for a while longer. We give dextri-maltose because it is usually much more easily handled by babies of this sort than lactose is, and is not so easily fermented. You remember I told you in a previous lecture how to make barley jelly; four tablespoons of barley flour to a pint of water; cook one hour in a double boiler, add enough water to make up to a pint again, strain and salt. This is an extremely valuable preparation to feed babies on (over a year

old) who are convalescing from diarrhea, either infectious or fermentative, and I want to urge you to use it a great deal more than you do: it is not used half enough. In fermentative diarrhea the digestion for fat is poor, as is that for sugar, but the digestion for starch in moderate amounts is usually good, because it is broken down so slowly in the intestine that its end-products are present in small amounts and have little chance to ferment. Powdered zwieback is also valuable to use in such conditions.

*July 12th.*—Weight, 19½ pounds. He is not doing well; he is very hungry, and has had a bad diarrhea for the last few days. When we examine the stools we see that they are of a greenish-brown color, slightly acid, without curds, and of a very mucilaginous consistence, with many small, jelly-like masses. When we examine them microscopically with Sudan III and acetic acid, we see that there is no excess of fat present, but when we add iodin, we see many small blue starch-granules. The appearance of this stool is absolutely characteristic of acute starch indigestion, so that is what is troubling this baby at present; he is either getting too much starch in his diet or is not digesting what he does get, at any rate. We had this baby on four tablespoonfuls of barley jelly a day, which certainly ought not to be too much for him, so let us ask the mother just how she makes the barley jelly and how much he takes of it. We find she *makes* it exactly according to the directions we gave her last week, but that she thought I said four tablespoonfuls *with each feeding*, instead of only four during the day, so the baby is getting 24 tablespoonfuls of barley jelly a day. No wonder he has starch indigestion. This illustrates the importance of writing down all orders for feeding cases. I should have done it for this one. Let us feed him as follows:

| | |
|---|---|
| Skimmed milk | 48 ounces (six feedings of 8 ounces) |
| Dextri-maltose | 3 tablespoons |

for two days, and then if he does well, change the feeding to this:

| | |
|---|---|
| Whole milk | 4 ounces |
| Skimmed milk | 44 " |
| Dextri-maltose | 3 tablespoons |
| Barley jelly | 3 tablespoons a day |

This gives a percentage of:

Fat 0.33 percent    Sugar 6.9 percent    Protein 3.2 percent

*July 19th.*—He is doing very well, is hungry and gaining weight. Two stools a day—no excess of fat. Weight, 20 pounds. Let us increase his feeding to:

| | |
|---|---|
| Whole milk | 16 ounces |
| Skimmed milk | 32 " (six feedings of eight ounces) |
| Dextri-maltose | 2 tablespoons |
| Barley jelly | 3 tablespoons a day |
| Zwieback | 2 a day |
| Orange-juice | 2 tablespoons a day |

*July 26th.*—Doing well, but has not gained. Stools one or two a day—normal looking. He has not gained, because he is still on a diet far below his caloric requirements, and he has grown tired of barley jelly and has refused it at nearly every feeding. It is safe to increase his diet a good deal this time, so let us give him:

| | |
|---|---|
| Whole milk | 24 ounces |
| Skimmed milk | 24 " |
| Dextri-maltose | 2 tablespoons (giving a percentage of fat, 2; sugar, 6.1; protein, 3.2) |
| Farina | 6 tablespoons a day |
| Zwieback | 4 a day |
| Orange-juice | 2 tablespoons a day |

Farina or Cream of Wheat is a most excellent food for small babies, and is probably the best cereal to give them after they have graduated from barley jelly. It is important to cook it very thoroughly; it should be cooked at least half a day in a double boiler. It is better to give it *without* sugar if the child will take it this way.

*August 2d.*—Weight, 21½ pounds—a gain of 1½ pounds in the last week. The child looks very much better and is going ahead fast.

How shall we feed him now? We can consider him now as essentially a normal baby, and we can feed him as such, except that we must still keep the fat in his diet rather low, or it is very doubtful whether he would take full Jersey milk even now.

He needs more *solid* food. A baby of this age, on a normal diet, should not take over a quart of milk a day, for if he does he will not take enough solid food. So let us cut his daily milk allowance to 32 ounces and have it mixed as follows:

| | | |
|---|---|---|
| Whole milk........ | 16 ounces | |
| Skimmed milk...... | 16 " | (four feedings of eight ounces each) |
| Dextri-maltose..... | 1 tablespoon | |

Fat 2 percent Sugar 5.3 percent Protein 3.2 percent

For the rest of his diet, give him the regular infant diet list, which I detailed to you in a previous lecture. He should have five meals a day, about as follows:

| | |
|---|---|
| 6 or 7 A. M.: | 8 ounces milk |
| 8.30 A. M.: | Cereal and 8 ounces milk<br>Zwieback and apple-sauce |
| 11.30 A. M.: | 8 ounces milk<br>Zwieback |
| 1.30 P. M.: | Soup or beef-juice<br>Mashed potato or macaroni<br>Mashed peas<br>Egg<br>Custard |
| 5.30 P. M.: | 8 ounces milk<br>Cereal<br>Zwieback<br>Stewed prunes or apple-sauce |

What are the lessons to be drawn from a study of this case?

1. Treat fermentative diarrhea due to carbohydrate with a food relatively low in sugar and fat and high in protein.

2. Be sure that the fat in the diet *is* actually low; that the mother is skimming the milk in the right way, and is doing it completely. Take into consideration whether or not the family has a Jersey cow. Many babies who are supposed to be on a practically fat-free milk may have stools *full* of fat and do poorly, simply because the milk is not being skimmed properly.

3. *Write down* carefully all directions to the mother: do not trust to verbal directions.

4. Raise the diet *slowly*, first adding a malt-sugar preparation and then starch (to babies over a year old). Then small amounts of fat. Write out the *exact quantities* of each article of diet the baby is to have.

CASE VI.—FERMENTATIVE DIARRHEA IN A SMALL BABY

J. C., male, five weeks old, is brought on account of diarrhea.

**Family History.**—Four other children well. No miscarriages. No tuberculosis in the family.

**Past History.**—Born at full term after a normal delivery. Birth weight, 8½ pounds. Breast fed five days, when the mother had abscesses in both breasts, which made artificial feeding necessary. He was put on ⅓ milk and ⅔ water, with milk-sugar added to about 6 percent, 2½ ounces every two and one-half hours. He did very well on this formula until yesterday, when he began to have diarrhea. Yesterday he had seven movements; today he has already had six up to 3 P. M. The stools are loose and green, but contain no blood or pus. They smell strongly acid and are also strongly acid in reaction.

**Physical Examination.**—A fairly well-nourished baby, moderately sick at the present time, with a temperature of 101° F. The physical examination is entirely negative: there is no cause for the diarrhea to be found outside of the digestive tract.

**Discussion and Treatment.**—This is a typical case of fermentative diarrhea of the carbohydrate type. The onset, the general condition of the baby, and the loose, green, acid stools are quite characteristic. The condition, as I have said before, is due to an abnormal fermentation of sugar in the intestine. This sugar is broken down into various acids, such as acetic and butyric, which irritate the intestinal mucous membrane and cause a diarrhea. The condition may be brought about sometimes by too great an amount of sugar in the food, which is broken down by the bacteria normally present in the intestinal tract, or it may be caused by the introduction of harmful bacteria from without, in unclean milk. In this particular case the condition is probably due to the latter cause, as this baby has been fed throughout on a reasonable sugar percentage. The general plan in treating these babies is first to empty the intestinal tract, if the baby has not already had enough movements to do this, and then to give a food low in sugar and fat and high in protein. The decomposition products of protein are alkaline in reaction, and if such a food as this, with a low fat and sugar content and a high protein, is given, the reaction

of the intestinal contents will return to normal. If there is little sugar there, it cannot be fermented, and so no more acid can be formed.

It will be best to purge this baby well, so let us give it two teaspoonfuls of castor oil, repeated in three hours. (If the diarrhea had existed for several days and the baby were having 12 or 15 stools a day instead of the 6 or 7 he is having, we would give no cathartic.) Then give sterile water, 2½ ounces every two and one-half hours for twenty-four hours, after which milk feeding may be started. Let us put this baby on the following formula:

| | |
|---|---|
| Skimmed milk | 12 ounces |
| Lime-water | 6 " |
| Water | 6 " |

2½ ounces every two and one-half hours; *boil* the mixture five minutes.

This gives a percentage composition of

Fat 0.0 percent Sugar 2.5 percent Protein 1.6 percent

The milk is boiled partly to sterilize it and partly to make the curd from the protein softer and smaller. As the movements improve, in the course of a day or two I would begin to substitute small amounts of whole milk for a portion of the skimmed milk, and would also add sugar up to 4 percent, in the form of dextri-maltose.

As the baby improves the modification can be gradually strengthened, until, in the course of seven or eight days, if everything goes well, he should be taking:

Fat 2 percent Sugar 5 percent Protein 1.6 percent
2½ ounces every two and one-half hours.

I should give no drugs of any sort other than castor oil to this baby. This is given because this particular baby *needs* a purge; its intestine has not been thoroughly emptied. Colonic irrigations would probably do this baby no good.

Eiweiss milk could be used in the treatment of this case, and it is likely that the bowels would clear up more quickly with the Eiweiss milk than they would on the mixture we prescribed, as there is less sugar and more protein in Eiweiss milk than there

is in our mixture. This baby, however, has not a very severe diarrhea, and will probably do well on the simple dilution we have prescribed, so there is no need of giving a complicated formula, especially as this mother is in very moderate circumstances, has four other children, and has a house to take care of, with no spare time on her hands to take up in mixing Eiweiss milk.

### CASE VII.—INFECTIOUS DIARRHEA

R. G., male, nineteen months, is brought to the clinic on account of diarrhea.

**Family History.**—Three more children well: none dead. No miscarriages. No tuberculosis in the family.

**Past History.**—Full-term, normal delivery. Birth weight unknown. Breast fed for fifteen months, then put on undiluted cow's milk, rice, eggs, cereal, and bread. He has never been sick, and has done very well in every way up to the onset of his present complaint.

**Present Illness.**—A week ago he began to have diarrhea, at first four or five then eight or nine loose brownish-green stools a day, containing a good deal of mucus. There was no blood in the stools at first, but for the past few days they have contained blood in streaks, intimately mixed with the mucus and fecal material. The number of the stools is increasing: yesterday he had 12, with a good deal of straining and tenesmus. Three days ago he had a temperature of 103° F.; since then it has been between 99.5° and 100.5° F. He has been considerably prostrated since the onset of his illness, is listless and apathetic, and has a very poor appetite. No nervous symptoms or vomiting.

For five days he has been fed on albumin water, about six ounces every three hours, with ten drops of brandy added to each feeding.

**Physical Examination.**—His general condition is only fair; he lies relaxed and limp, and takes very little interest in anything. His eyes are sunken, his skin is loose and dry, and his abdomen is considerably sunken. He seems to have lost a good deal of weight.

There is nothing else of interest about the physical examination.

**Treatment.**—There is no use in giving a purge to this baby; the time to purge him was at the onset of his illness, when he was having only a few stools a day and was in good general condition; but at present he is having so many stools, and so much straining with them, that it would undoubtedly do him more harm than good to purge him now.

There seems to be no reason for starving him either; he has been practically starved for a week, and let me say here a word or two about starvation in this condition. It is not good practice to starve a baby too long; rarely should any baby with infectious diarrhea be starved over twenty-four to forty-eight hours. I know that we all used to starve our cases of infectious diarrhea, sometimes for long periods, but experience has shown that this is not the best method of treatment, and that these babies will do much better if they are fed a weak milk mixture almost from the very first, after a short period of starvation. I have seen a great many cases of infectious diarrhea fed on albumin water, and do not believe in it—for two reasons: First, because there is practically no nourishment in albumin water, and we do not wish to starve the baby; secondly, because albumin water consists entirely of protein (and water), and the dysentery bacillus, which is the cause of most cases of infectious diarrhea, attacks protein very readily, and forms toxic decomposition products from it. So the indications are, in treating most cases of infectious diarrhea, to feed a food high in carbohydrate and low in protein, as the dysentery bacillus does not readily thrive on carbohydrate food, and the decomposition products which it produces from carbohydrate are not particularly toxic.

To return to our baby. A reasonable feeding on which to start this baby would be the following:

| | |
|---|---|
| Skimmed milk | 14 ounces |
| Barley water (1.5 percent) | 14 " |
| Lime-water | 7 " |
| Boiled water | 7 " |
| Lactose | 6 level tablespoons |

Seven feedings of six ounces each.

This gives the following percentages:

Fat 0.0 percent  Sugar 7 percent  Protein 1 percent  Starch 0.5 percent

As you can see, this is a food low in fat and protein and high in sugar. It is always important to keep the fat low in feeding these babies with infectious diarrhea, as it is usually impossible for them to digest even small quantities of fat. This formula could soon be raised to the following:

| | |
|---|---|
| Skimmed milk | 21 ounces |
| Barley water | 14 " |
| Lime-water | 7 " |
| Lactose | 6 level tablespoons |

The principles in the further dietetic treatment of this baby are these:

1. Gradually raise the strength of his food until, as he is beginning to convalesce and is having fewer stools, he will be taking undiluted skimmed milk with sugar added to 6 or 7 percent. Also, at this time, he can be given a little more starch in the form of barley jelly, farina, or powdered zwieback.

2. The last thing to do is to raise the fat, and this should be done slowly, by substituting every few days an ounce or two of whole milk for an equivalent amount of skimmed milk.

3. As he convalesces gradually add other articles of food to his diet, remembering that no baby of this age can thrive on milk alone. This baby's digestion for starch will probably be good, so that barley jelly, farina, powdered zwieback, mashed potato, macaroni, etc., are the articles of solid food that you will rely on mostly for his subsequent diet. As he progresses he can be given beef-juice and a small amount of finely chopped meat. If he shows any tendency to sugar fermentation, it will be best to substitute maltose for lactose.

At the present time I would give this baby no drugs, except possibly a few *small* doses of paregoric to diminish the tenesmus, which has apparently troubled him a good deal in the last day or two.

It is important to give him water between his feedings, and this I would do. Also, as this baby has lost a good deal of fluid and at the present time is pretty well dried out, I would give him about 200 c.c. of normal salt solution subcutaneously. I feel that this is very important in treating these babies, and it will often give surprisingly good results. I believe that in a good

many fatal cases of infectious diarrhea the loss of fluid from the body is one of the most important factors in causing death. It is best not to give the fluid under the breasts, as is usually done, but to give it in the loose tissue of the abdomen on either side of the umbilicus. A baby with infectious diarrhea has none too much strength; it is important to conserve as much of it as possible, and if a pint of water is suddenly placed on his chest and he has to raise it (sometimes a tenth or a fifteenth of his own weight) every time he breathes, it may tire him a good deal.

At present I should give no colonic irrigations to this baby, but later on, if his stools do not clear up as well as they should, and they continue to show a good deal of pus and mucus, I would give him every day a high colonic irrigation with 3 percent silver nitrate solution.

## CASE VIII.—ACUTE RICKETS

J. S., male, was seen March, 1917. Age, nine months.

**Complaint.**—Poor appetite; failure to gain.

**Family History.**—Not remarkable.

**Past History.**—Full term; difficult high forceps delivery. Birth weight, seven pounds. Never breast fed.

**Feeding.**—He has always been fed on "top-milk" mixtures, and these have contained a high percentage of fat—usually over 4 percent. For the last month he has been on the following feeding:

| | |
|---|---|
| Top (14 ounces of two quarts) | 25 ounces |
| Skimmed milk | 13 " |
| Dextri-maltose | 6 level tablespoons |

Five feedings at four-hour intervals; from 6½ to 7 ounces at a feeding. With this he also gets about six teaspoonfuls of beef-juice a day.

**Present Illness.**—He gained weight very satisfactorily up to four weeks ago. The mother has been plotting the weight curve in Dr. Holt's little book, and it has followed the theoretical curve very closely up to this time. For four weeks his weight has remained stationary, however. His appetite is poor: sometimes he takes only three or four ounces at a feeding. He never vomits. He has one or two very large, pasty,

light-colored stools a day. For the last few weeks he has been very fussy, sleeps poorly, cries a good deal, and sweats profusely, especially about the head. At no time has he had any apparent fever. Weight, 17¾ pounds.

**Physical Examination.**—Looking at this baby casually, with his clothes on, one would be inclined to consider him a fairly healthy baby, except for a certain pallor, and this is what his parents have considered him: an unusually strong and healthy baby. He is bright and active, and interested in his surroundings.

When his clothes are removed, however, it is easy to see that he is in poor condition. The essential points of the physical examination are these:

*General Condition.*—Flabby and soft; his skin hangs loosely upon his flesh.

*Skin and mucous membranes:* Pale.

*Head:* Normal in shape; anterior fontanel and sutures widely open. No craniotabes.

*Throat:* Large tonsils and a discharging nose, which means infected adenoids. He has no teeth.

*Lymph-nodes:* Generally enlarged, especially those of the neck, some of which are as large as marbles.

*Chest:* Small in comparison with the abdomen. A well-marked "rosary" is present, but no Harrison's grooves.

*Lungs:* Normal.

*Heart:* Normal.

*Abdomen:* Large and flabby, with very thin, lax walls. Diastasis of recti muscles. The liver edge is felt about 3 cm., and the spleen easily 2 cm., below the costal margin.

*Extremities:* Negative; no enlargement of the epiphyses; no tenderness; no spasm or paralysis. Knee-jerks normal.

**Discussion.**—Of course, this baby has acute rickets. The anemia, flabbiness, delayed dentition, enlarged spleen, rosary, etc., make this diagnosis unmistakable.

The question is, how did he get it and what can be done for him?

As I said in the lectures, rickets is a complex condition, and may be due to a number of causes, either singly or combined. Poor hygienic surroundings have nothing to do with this baby's

condition, as his parents are very well to do and he has always had the best of everything. The cause of his trouble is to be looked for in his feeding: he has always been fed on a food very high in fat. The formula that he is taking now contains a little over 5 percent, which is altogether too much for him. This excess of fat has, however, not been enough to upset his digestion much, to make him vomit or to give him a diarrhea. The way in which it has done him harm is this: the fat of cow's milk is not easily absorbed, partly owing to the fact that the free volatile fatty acids of the fat combine with the calcium salts of the milk and form insoluble calcium soaps, which cannot be absorbed. Thus, on account of the large amount of fat in this baby's food, the calcium of the food, which should be absorbed, has been rendered unavailable, and on account of this long-continued loss of calcium he has developed rickets. Not all cases of rickets are caused in this way, but a great many are, at any rate.

According to my way of thinking, the feeding of this baby has been entirely wrong from the start. I very rarely believe in four-hour feeding intervals for most babies under a year old. If they are fed in this way, it is necessary to feed them too concentrated a food, and I have happened to see lately a number of babies who have come to grief fed by this method.

There was no opportunity to analyze the stool of this baby, but I am sure that if an analysis had been possible, at least 40 percent of the fat intake would have been found in the stool, a large part of it in the form of calcium soap.

**Treatment.**—*Feeding.*—The feeding of this baby was changed to the following Walker-Gordon formula:

| | | |
|---|---|---|
| Fat | 3.00 | percent |
| Sugar (dextri-maltose) | 8.00 | " |
| Protein | 2.40 | " |
| Barley starch | 0.75 | " |

Sodium citrate 1 grain to the ounce of milk and cream.

Seven to eight ounces every three hours; six feedings in twenty-four hours.

(About the same percentages could be obtained in a home modification by using 36 ounces of whole milk, 12 ounces of 3 percent barley water, dextri-maltose, 6 level tablespoons, sodium citrate, half a teaspoonful.)

The baby has not been seen since he was put on this formula, but I feel sure that he will do better on it than he did on the other.

Ordinarily, beef-juice would not be given to a baby as young as this, but it has probably done him no harm, and it may as well be continued. Personally, I think that beef-juice is greatly overrated, and while I do use it, do not consider it at all a necessary part of a baby's diet.

*Drugs.*—Iron is definitely indicated for the anemia, and saccharated oxid of iron, 3 grains three times a day, was prescribed.

The following prescription was also given:

| | |
|---|---|
| Phosphorated oil........................ | 20 minims |
| Cod-liver oil............................. | 4 ounces |

One teaspoonful once a day; after a few days, twice a day.

It is very doubtful whether cod-liver oil and phosphorus do much good in rickets, but they are worthy of a trial. Cod-liver oil in small amounts is assimilated more easily than cow's fat, so even if the baby has been taking too much fat, there is no contraindication for the small extra amount of fat that he will get in the oil.

*Fresh air and sunlight* are of the utmost importance for this baby. He should be out-of-doors or on an open porch nearly all day on reasonably good days. It must be remembered, however, that he is anemic, and that for this reason he will not stand cold well, and should not be sent out on very cold days.

**Prognosis.**—It will be possible to make him gain weight, to help his anemia and general condition, and, I hope, to arrest or to modify the rachitic process. Just how much this process can be arrested or modified, however, is a question, but it does not seem likely that this case will be a severe one, and it is probable that the baby will recover without any serious deformities.

## CASE IX.—MIXED BREAST AND BOTTLE FEEDING

R. W., male, is first seen February 10, 1917. Age, eight weeks.

**Complaint.**—Failure to gain.

**Family History.**—The only child of healthy parents. No miscarriages, no exposure to tuberculosis.

**Past History.**—Born at full term, normal delivery. Birth weight, 7¾ pounds. Breast fed every two and one-half hours.

**Present Illness.**—The baby is brought on account of failure to gain weight; he has remained stationary at eight pounds for several weeks. It takes him half an hour to empty the breast, and then he is not satisfied. No vomiting. Movements one a day, small, rather hard, and constipated. The mother says she thinks she has very little breast milk. She is a young, highly intelligent, normal appearing woman, is on a reasonable diet, and is drinking about two quarts of fluid a day.

**Physical Examination.**—A rather small, poorly nourished baby, who has apparently started on the road downhill. His flesh is flabby, and his skin is loose and pouchy, although he is not in an extremely emaciated condition. Weight, eight pounds (weight of a normal baby of eight weeks should be about ten pounds). The rest of the physical examination is essentially negative.

**Discussion.**—Although this case is by no means a difficult or a complicated one, I have included it because it represents a very important group. There are a great many women who can partially nurse their babies, but who have to be helped somewhat with the bottle. This woman is of this type: her milk is agreeing with the baby perfectly, although there is not quite enough of it. The point I want to emphasize particularly is this: *never wean a baby simply because the mother has too little milk or because it is too weak. Even if she can give the baby only four or five ounces a day, let him have it.* It may seem quite unnecessary to lay so much emphasis upon this, but I have seen dozens of babies taken off the breast entirely and put on various proprietary foods simply because the mother did not have enough milk for them. The thing to do in such cases is to help out the breast milk by *supplementary* feedings of the bottle. The bottle milk is usually given immediately after each nursing, although if the mother has only a very little breast milk, it will probably be necessary to have several feedings at which the bottle is given alone. There are relatively few women who can nurse their babies successfully for a whole year, and mixed feeding often has to be resorted to, usually with very good results.

**Treatment.**—In this particular case the treatment was as follows: The mother was instructed to nurse the baby fifteen minutes every two and one-half hours—eight feedings in the twenty-four hours, and immediately after each nursing to give two ounces of a Walker-Gordon modification containing the following:

$$\text{Fat 2 percent} \qquad \frac{\text{Lactose 5 percent}}{\text{Maltose 1 percent}} \qquad \text{Protein 1.4 percent}$$

Sodium citrate, 1 grain to each ounce of milk and cream in the mixture.

The maltose was added to correct the constipation, which it did very effectually.

If this particular formula had been prepared at home, it would have been made as follows:

| | |
|---|---|
| Gravity cream | 2 ounces |
| Skimmed milk | 5 " |
| Water | 9 " |
| Milk-sugar | 1⅓ level tablespoons |
| Maltine malt soup | 1 scant level tablespoon |
| Sodium citrate | 7 grains |

The baby did very well on this feeding, and started to gain immediately. On February 17th his weight was 8 pounds 10 ounces, a gain of 10 ounces in one week, and his progress thereafter was very satisfactory.

# CLINICAL LECTURES
ON
# INFANT FEEDING

*Chicago Methods*

BY

JESSE ROBERT GERSTLEY, M.D.

TO

DRS. I. A. ABT, JULIUS H. HESS, ERNEST LACKNER, AND JOSEPH BRENNEMANN

THE MEN WHO FIRST STIMULATED ME TO DREAM OF A EUROPEAN EDUCATION, AND TO

MY PARENTS

WHO MADE THIS DREAM A REALITY

# PREFACE

The following lectures are the result of many influences. Two years spent in the European clinics with Finkelstein and his able assistants, L. F. Meyer and Ivan Rosenstern, with Czerny and with Knoepfelmacher, gave the writer the foundation. It was upon the recommendation of Dr. Julius H. Hess, Professor of Pediatrics at the University of Illinois, that the writer went to North Carolina. The welcome coöperation of the State University and the State Board of Health was invaluable in its effect. To the energy and interest of Dr. J. W. Long, organizer of the western sections, and chairman of the splendid organization of men in Greensboro, the writer is particularly indebted. He was a constant encouragement and a large factor in the success of the work. The warm hospitality and great personal kindness of Drs. Henry Long, of Statesville, Mitchell Summerell, of China Grove, F. Raymond Taylor, of High Point, R. E. Flippen, of Pilot Mountain, I. W. Faison, of Charlotte, and many other good friends in North Carolina, changed an exceedingly hard summer into a pleasant vacation. Before commencing his own course the writer had the pleasure of hearing several clinics of his friend, Dr. Lewis Webb Hill. This privilege aided the writer greatly in outlining his own work. Many subjects which Dr. Hill covered thoroughly, the writer omitted in order to avoid unnecessary repetition.

Those of the readers who are familiar with Finkelstein, may find in the following pages some variations from his writings. These are due to unpublished views obtained in personal conversation, and to others which the writer has introduced upon his own responsibility and from his own experience.

In classifying the following pages as Chicago methods of feeding, the writer by no means wishes to imply that these are the methods of *all* Chicago pediatricians. However, he believes himself justified in stating that the majority of Chicago

men have been influenced to a decided extent by the schools of Finkelstein and Czerny.

The clinics following the lectures are made up of the case records of the course. In his notes the writer at times neglected to record the names of the physicians bringing the patient or raising questions for discussion. He has attempted to fill these in from memory, and so may have made errors. He trusts that this liberty, taken in the interest of teaching, will be overlooked. The curves are elaborations of the crude blackboard sketches; the photographs are from our hospital wards, taken to help illustrate the discussions.

The writer is indebted to Dr. Alexander Day, of Northwestern University Medical School, for his kind suggestions as to the charts, to Mrs. Edna Walsh for much help in the manuscript, and to the publishers for their many courtesies.

Jesse Robert Gerstley

Chicago, Ill.,
September, 1917.

# CLINICAL LECTURES ON INFANT FEEDING (CHICAGO METHODS)

## LECTURE I

## INTRODUCTION

Gentlemen: In coming to discuss with you the subject of children's diseases, I have been confronted with a serious problem. To cover thoroughly the entire field of pediatrics in thirteen lectures is obviously impossible. To skim over it superficially would leave you only with false impressions, would be worse than useless, and would do more harm than good. In attempting to plan the course, I thought it might be wiser to devote most of our time to those subjects in which ignorance or lack of experience of the physician leads to greatest injury to the patient. Probably in no other field of medicine are graver mistakes made than in that of infant feeding and nutrition. Lasting misfortunes are brought upon infants from sheer ignorance of some of the simplest rules of feeding and hygiene. Indeed, one almost might say that if we have mastered infant feeding, in addition to a little hygiene, there would be *no sick* babies. Don't take this statement too literally. But I make it boldly, and repeat it, to show how much emphasis I lay upon the subject. For this reason I intend devoting the major part of the course to these considerations.

In the clinics following the lectures we probably shall see and discuss some of the more familiar conditions.

In the lectures upon infant feeding and nutrition we shall follow rather closely the teachings and viewpoints developed by the Finkelstein clinic and its converts. I also shall take the liberty of including in these discussions points advanced by other clinics; may at times venture to criticize some of these views on the

basis of my personal experience, and occasionally shall insert ideas of my own. Don't misunderstand me; we of the Middle West have absolutely no objection to the percentage system of feeding. It undoubtedly gives good results in the hands of men used to it; but we believe our methods simpler to use and simpler to teach than those more commonly employed in the United States.

## MILK

When we seek a substitute for breast milk, there is one, and only one, to offer, and that is cow's milk. No greater injustice can be done to a child than by failure of the physician to recognize or know this truth. No matter what advertisements you read; no matter what claims are made for proprietary foods, absolutely no substitute has been found for cow's milk. In view of its importance, let us devote ourselves this morning to a rather careful study of it, considering its chemistry, bacteriology, and physical qualities.

After you realize the importance of cow's milk as a food all the more striking must be the statement of M. J. Rosenau, the eminent professor of preventive medicine at Harvard, from whose writings on milk I now rather extensively quote, that milk is responsible for more sickness and more deaths than all other foods combined. Gentlemen, just think what this statement means: The one food *next* to breast milk in quality is responsible for more deaths, not than any other food but than *all* other foods combined! And it is this food we must feed our babies.

According to Rosenau, the reasons for this statement are four:

1 Milk is an ideal culture-medium for bacteria. They grow very well in it.

2. It is the most difficult of all foods to handle and to deliver.

3. It is the most decomposable of all foods.

4. It is the only standard article of diet obtained from animal sources used raw. When one stops to think how we cook meat, eggs, boil soups, and cook all animal foods, it is surprising that we still use milk in raw form.

## COMPOSITION OF MILK

Milk is composed of five elements of food—not three, as we were wont to consider, but five. These five are: protein, fat, carbohydrate, *salts*, and *water*. It is the salts and water that are so frequently overlooked in the feeding of children and in the treatment of nutritional disturbances, and which are of such importance. We shall hear more of them.

**Protein** is the substance which, in connection with salts, gives structure to the tissues. Protein is composed, in a general way, of carbon, oxygen, hydrogen, and nitrogen. When we speak of nitrogen-containing foods, we mean protein in distinction to the fats and carbohydrates, which contain only carbon, oxygen, and hydrogen. Protein in the milk is not, as you may think, a specific element, but exists as two kinds, viz., casein; and albumins and globulins.

**Casein** is the substance that forms thick curds when milk is coagulated. The curds in buttermilk are of casein, and it is this casein that is the most important form of protein as regards infant feeding.

**Albumins and globulins** form a scum on top of the milk when it is boiled. We always have thought them unimportant as regards feeding.

**Fat** exists in the milk as an emulsion of fat-droplets. As a food, it is of value in supplying some energy to the body, and also is stored up in the tissues. It is the most variable constituent of the milk. The first milk of the nursing or of the milking is poorest in fat. The last is richest. Fat varies in the milk of different animals. Jerseys and Guernseys contain more than Holsteins, and, not infrequently, a baby who is vomiting can be cured by changing from the milk of a Guernsey to a Holstein.

**Carbohydrate** in milk, commonly known as sugar of milk, and technically called *lactose*, is of value in supplying energy to the body. Like casein, lactose is found only in the mammary glands and nowhere else in nature. When bacteria attack it, it usually is changed to lactic acid, this being the acid that is formed in buttermilk; so buttermilk is simply milk in which the fat has been removed and the sugar changed to lactic acid.

**Salts** in connection with casein furnish structure to the tissues,

and are vitally concerned in many of the nutritional disturbances.

**Water** is perhaps the most important element in the body, being the universal solvent and constituting the greatest proportion of the body tissues.

Besides these substances, a great variety of drugs and also some ferments may be found. From the standpoint of medicine these drugs are unimportant, because they rarely are of sufficient quantity to have any effect upon the child. An exception may be made, however, in the case of cows that have eaten poisonous weeds and grasses.

## ADULTERATION OF MILK

If you, gentlemen, are interested in the study of children's diseases, you must know the ways in which milk is adulterated. The most common methods are skimming, watering, adding thickening agents and preservatives. To detect these adulterations three means are at our disposal:

1. Simple inspection.
2. Bacteriological tests.
3. Chemical tests.

The method that I would recommend to you, one which is simple enough for any one, is that of inspection. Take the milk and look at it. Here, of course, you detect gross changes. Then filter through a piece of cotton placed in a little funnel. Heating the milk makes it filter more easily. On this cotton you will find a stain varying from light brown to black, depending upon the amount of dirt. Looking at the cotton, one finds all sorts of things; Cow's hairs, manure and feces, scales of her skin, sand, straw, and food. It is well to remember that a wise milk-dealer sometimes filters the milk before selling it.

The only chemical test that I would recommend is the Babcock. This requires a special apparatus, but those who are interested may at some time wish to have one. It is a quantitative test for fat. This is the technic:

Take 17.5 c.c. of milk
17.5 c.c. of sulphuric acid
2.0 c.c. of amyl alcohol

I give you these in the metric system, for the tubes are graduated that way. Remember that 30 c.c. equal 1 ounce; so we are using approximately one-half ounce each of these fluids. Centrifuge for four minutes; then add boiling water to bring the fat up into the graduated neck of the tube; centrifuge for two minutes and read.

Other chemical and bacteriological methods require special training.

## DIFFERENCES BETWEEN COW'S MILK AND BREAST MILK

A proper understanding of the difference in the composition of cow's milk and breast milk is absolutely essential to the feeding of infants and is the *basis* of all our methods of treatment. Let us give you this little table, which, though not absolutely accurate, still is sufficient for all practical purposes:

| *Breast Milk* | | *Cow's Milk* | |
|---|---|---|---|
| Protein | 2.0 percent | Protein | 4.0 percent |
| Fat | 4.0 " | Fat | 4.0 " |
| Carbohydrate | 6.0 " | Carbohydrate | 4.0 " |
| Salts | 0.2 " | Salts | 0.7 " |
| Water | 88.0 " | Water | 87.0 " |

An easy way of carrying these numbers in your head is this: breast milk being 2 4 6; cow's milk 4 4 4. Looking at this table, one gets the impression that the only difference between the two milks is in the amount of the different constituents. This, however, is not the case.

Protein, as you remember, exists in the milk as two different elements: casein, and albumin and globulin. The proportion of these elements in the milk is entirely different.

Protein of cow's milk contains:

| | |
|---|---|
| Casein | 85+ percent |
| Albumins and globulins | 14+ " |

The protein in the breast milk consists of:

| | |
|---|---|
| Casein | 61+ percent |
| Albumins and globulins | 38+ " |

To emphasize this all the more, look at the weights. If we

take 100 grams (a little over 3 ounces) of milk and weigh these different proteins, we find:

*Cow's Milk*

| | |
|---|---|
| Casein | 2.7 grams |
| Albumins and globulins | 0.2 gram |

*Breast Milk*

| | |
|---|---|
| Casein | 0.8 gram |
| Albumins and globulins | 0.6 " |

Notice the preponderance of casein in cow's milk; and now, in addition to this, there is also a difference in the caseins of the mixtures themselves. Cow's-milk casein precipitates in firm, thick curds; breast-milk casein forms only the finest curds—sometimes none at all; and cow's-milk casein contains much more phosphorus than breast-milk casein. I emphasize these differences to show how futile it is to attempt to modify cow's milk so as to make its protein identical to that of breast milk.

So far as we know at present, the composition of breast milk cannot definitely be influenced by diet other than that a poorly nourished woman, who secretes little milk, may perhaps be made to produce larger quantities by building up her nutrition.

**Fat.**—Like the proteins of the two mixtures, the fats are of somewhat different chemical composition. The fat of cow's milk contains more of the irritating lower fatty acids, of which butyric acid is an example, and there may even be some biological variations.

**Carbohydrates,** so far as we know, are alike.

**Salts.**—Like the protein and the fats, there is great difference in the salt content of the two mixtures, not only in quantity, but in quality. Those in cow's milk are chiefly calcium and magnesium; those in breast milk, chiefly sodium and potassium. So you see we cannot, in any simple way, modify cow's milk so as to make its *salt* content identical to that of breast milk.

## BACTERIAL GROWTH IN MILK

In offering an infant cow's milk, we frequently overlook the rapid growth of bacteria that may have taken place if the milk has not properly been cared for. Even if it has been kept at a

relatively low temperature, within two days bacteria will have multiplied by the millions, and at warmer temperatures the numbers found are absolutely incredible. Rosenau's statement certainly is impressive when he says that the milk we drink or we offer to an infant may contain more bacteria than are found in ordinary sewage. Just think of this! In feeding your babies milk mixtures you may be feeding more bacteria than are in *ordinary sewage!* These bacteria are usually of the type attacking the sugar and forming lactic acid, thus making sour milk, but they may be of any sort, and as they grow they may produce two important types of change:

(1) If they attack carbohydrate they produce acid, this process being known as fermentation. In this fermentation usually lactic acid is produced, but under certain conditions other acids also result.

(2) If, on the other hand, they attack the protein, they produce alkaline products, this process being known as putrefaction.

Gentlemen, I urge you to distinguish sharply between these two processes and remember that we shall hear of them time and time again. You cannot feed a normal baby, nor can you treat a baby sick with nutritional disturbance unless you have this clear-cut understanding of the changes that bacteria produce in milk. Let me repeat: *When bacteria attack carbohydrate, the process is known as fermentation, and acids result. When bacteria attack protein, the process is called putrefaction, and alkalis result.*

From our standpoint of feeding, however, we must remember that the numbers of bacteria that are present in milk are by no means as important as the kind, and this brings us to the discussion of the diseases which are known definitely to be carried by milk.

## MILK-BORNE DISEASES

Studies have shown that tuberculosis, typhoid, diphtheria, scarlet fever, dysentery, and many other diseases have been traced to the milk supply. A study made in Boston some time ago shows what a factor milk can be in spreading disease, particularly among children. To quote Rosenau:

In 1907, in Boston, 72 cases of diphtheria and 717 cases of scarlet fever were transmitted by milk. In 1908, 400 cases of

typhoid were due to this cause. In 1910, over 842 cases of scarlet fever had this same origin; and in 1911, over 2065 cases of septic sore throat again were due to this cause. Gentlemen, see what a tremendous factor milk is in the distribution of disease, and to what unnecessary danger we subject our babies in offering them this food. But don't forget that in spite of all this, cow's milk still is by far the best substitute for breast milk that we have. Cow's milk may become infected in different ways: it may be directly infected when obtained from the cow, but this is rare. About 2 percent of tuberculous cattle have involvement of the udder, and in these the milk may contain as many tubercle bacilli as does the sputum of tuberculous patients. Again, the cow with pulmonary tuberculosis coughs up the organisms, swallows them, and they get distributed throughout the manure in the stable. During the milking they are whisked into the buckets, and these buckets of milk then being added to others, distribute tuberculosis throughout the community. Rosenau quotes a study of market milk in Chicago in 1910 which showed that 10.5 percent of 144 specimens examined contained tubercle bacilli, as did 16 percent of all specimens of butter examined. In the same way other diseases are distributed, the most common one being typhoid. Widespread epidemics of this disease have been reported in all parts of the world, and have been traced absolutely and definitely to the milk supply. The organisms get into the milk, as a rule, not so much from a case of active typhoid as from a so-called typhoid carrier who works around the farm, viz., a man in perfect health who harbors typhoid organisms in his excretions.

How are we going to avoid these dangers in feeding our babies? How are we going to offer babies cow's milk and, at the same time, not make ourselves liable to the terrible accusation that *we* have infected our babies with tuberculosis, typhoid, or dysentery? There are at present three methods at our disposal:

*a*. Pasteurization.
*b*. Demanding of certified milk.
*c*. Boiling.

I am going to speak very little of pasteurization, because if you are in no position to get certified milk, I doubt whether a State pasteurization law would be a great success. Indeed,

pasteurization may do more harm than good. Do you remember that we spoke previously of the changes that bacteria cause in milk; that when they attack carbohydrate, lactic acid is formed? The greatest percentage of cases of spoiled milk result from fermentation and formation of lactic acid. This lactic acid in itself is not harmful, and by its presence not only may show that the milk has been improperly handled, but also may prevent dangerous organisms, such as typhoid or dysentery, from growing. If we should pasteurize the milk back on the farm, thus killing all the germs that produce lactic acid, and then, after having done this, we should permit a typhoid or a dysentery bacillus to get into that milk, this organism would have a perfectly clear field for growth. If, on the other hand, the milk were unpasteurized and it became spoiled, in the great majority of cases the lactic acid produced might prevent the growth of the more deadly organisms. So if you are not in a position to keep that milk absolutely free from contamination to the time of its delivery, I would not unreservedly recommend pasteurization.

The term "certified milk" was introduced by Dr. Henry Coit, of Newark, N. J. According to our present conception, certified milk is simply milk of the highest quality, uniform in composition, obtained from healthy cows under the supervision of a milk commission. I should advise you to become interested in this subject. What is necessary is for some of you to form a committee and enter into a contract with a reliable milk dealer. The dealer must allow frequent inspection of his dairy and frequent analyses of the milk. The cows must be pronounced free from tuberculosis by a reliable veterinarian, and must show a negative tuberculin test. They must be free from all communicable disease. They must be housed in clean, properly ventilated stables; the old wooden walls must give way to brick; the floors must be sloping to allow for flushing and to prevent the accumulation of waste and manure around the stalls. All persons coming in contact with the milk must be free from the germs of typhoid, tuberculosis, and diphtheria, and must observe scrupulous cleanliness. The milk must be drawn with the strictest care; the cows washed before milking; the tail tied to the leg, and the udders cleaned. The attendants,

dressed in white, must observe great cleanliness during the milking process. The milk should be immediately cooled, placed in sterilized bottles, and kept at a temperature of not over 50° F. until delivered. It must be delivered within twenty-four hours after milking, and at that time may contain no more than 10,000 bacteria per cubic centimeter. I should certainly advise you, gentlemen, to take some interest in establishing a certified milk dairy in this neighborhood.

Until certified milk can be obtained, however, there is one method that remains for making perfectly safe the milk that you are feeding your babies, and that you may employ right now—this very day—*boil your milk!* In the olden times—a few years ago—when the science of bacteriology was being developed, it was thought necessary to boil and reboil the milk in order to kill any bacteria that it contained, and in these processes changes took place which made the milk a rather dangerous food. Children being fed this way frequently developed scurvy. Now we know, however, that if milk simply is brought to a boil and boiled gently for a minute or two, no such danger exists. We can speak with *absolute assurance* as to the harmlessness of feeding milk so treated. Just look for a moment at the European battle-fields. The men of France, Austria, and Germany seem to be pretty good fighting men, and every one of them who, when an infant was not fed on breast milk, was raised on boiled milk. In those countries raw milk is unknown. So you see that very good fighting men can be raised on boiled milk. If you wish to make yourself entirely safe,—to have your conscience perfectly free,—you may add a little orange-juice to the diet during the second month, and with this routine I can assure you that no case of scurvy ever will develop from this cause.

In the discussion of boiled milk another question is raised which is of particular interest to me, for it was in Chicago that a very important problem along these lines was solved. The German pediatrician, Biedert, described curds appearing in the baby's stools—curds which were hard, white, and very much like a lima-bean in appearance. He said these curds were protein, and used them as evidence of the indigestibility of casein. This view later was corroborated by other observers. The new Ger-

man school, however, took a different view of the matter. Using more scientific methods, they fed children casein and found hardly any increase of nitrogen in the stools; and they argued that as feeding casein causes no increase in nitrogen in the stool, these curds could not be protein. American observers then became interested, and, if I remember correctly, Talbot, of Boston, was one of those insisting upon the fact that these curds *did* consist of casein. The Germans rather scorned this view, and claimed that the American methods were inaccurate. The Americans replied with more delicate experiments, using serological methods, and again claimed that the curds were casein. The Germans replied that the methods now were too delicate, and that the Americans had identified the small amounts of protein that were present in the intestinal juices, but that the main structure of the curd was fat. The controversy waxed quite warm, and was finally settled by Joseph Brennemann, of Chicago, in one of the most important pieces of work that has been done in the field of pediatrics in America.

Brennemann studied the cases coming to the dispensary of our medical college at home, Northwestern University Medical School. He found that the stools of many infants contained these curds. Careful study and observation showed that the curds varied from day to day—some days being present, some days absent. Careful questioning showed that at times the mothers boiled the milk, at times they didn't, and continuation of the study revealed the extremely interesting fact that on the days when milk was boiled the curds disappeared from the stools. When the milk was used raw, they returned. Here, then, was the simple solution of the great problem that had been vexing Europe and America. On the continent, where raw milk is unknown, the men never had even seen these casein curds, and, sure enough, what they had seen were curds of fat. In this country, with the previously invariable use of raw milk, we saw the true casein curd. So you see that the whole controversy was caused by our discussing and describing different things, and I can't help thinking that probably many of the great problems in pediatrics may be due to this same fundamental error—describing and talking about *different* things. The formation of these curds is purely a physical process. It has nothing to do

with digestion. They will form in the bottle as well as in the stomach, and are due not to digestive trouble, but simply to shaking of the milk after a ferment has been added. If we add a ferment to milk in a bottle and shake it violently, hard, tough curds form. The same holds true in the stomach. If, on the other hand, we introduce the milk into the small intestine by means of a Hess tube, thus saving it the mechanical shaking in the stomach, none of these abnormal curds form. The problem of this curd formation, then, is simply one of physics, and is not of particular interest to us from the standpoint of physiology.

To conclude: remember, first, the fundamental differences between cow's milk and breast milk; remember that these differences are not only in the quantity of the individual ingredients, but also in quality, and that with no simple means at our disposal can we make cow's milk identical to breast milk. Remember that when cow's milk is not properly handled, bacteria grow in it at a tremendous pace. In their growth they may cause one of two changes. If they attack the carbohydrates, they produce acids, this process being known as fermentation; if they attack protein, they produce alkaline products, this process being known as putrefaction. I urge you, gentlemen, not to forget these two processes: *fermentation* and *putrefaction*. We shall hear them time and time again.

Breast milk being high in sugar and low in protein favors fermentation. Cow's milk being high in protein and low in sugar favors putrefaction.

Remember, however, that the quantity of bacteria is not so important as the quality, and that milk which may be swarming with lactic acid germs is not nearly so deadly as that which may contain smaller numbers of typhoid or tubercle or dysentery bacilli. If you wish to have a clear conscience in feeding your babies; if you wish to feel certain that *you* have not been responsible for a death from tuberculosis or typhoid or dysentery, you must see that the milk is pure. You have three methods at your disposal: The one I urge upon you is to *boil* the milk. In doing this you will positively work no injury to the child; you will change the protein so that no hard curds will appear in the stool, and you will protect the child from the deadly milk-borne diseases.

## LECTURE II

# DIGESTION OF MILK

Gentlemen: In the last lecture we discussed the subject of milk. Today we take up "milk and the baby," considering carefully the changes that each causes in the other. We shall dwell upon the points in practical physiology that we absolutely must know in order to understand what is to come. Even if some of them seem a little abstruse or impractical, nevertheless I urge you to follow me, for you will find that I am telling you nothing that will not later be of importance. I am going to quote freely from Langstein and Meyer, which we should use as our text-book.

The old idea of the digestion of protein was that in this process the protein simply became soluble. Now we know that protein digestion is a far more complicated process, the protein literally being torn to pieces by the ferments of the digestive tract. The individual fragments are called amino-acids. In the process of assimilation, these amino-acids are put together again and built into the structure of the baby's tissue. Protein digestion begins in the stomach and is completed in the intestine.

In the intestine, protein performs an important function; viz., its digestion requires large quantities of alkaline intestinal juice, and in this way protein becomes associated with the formation of an *alkaline* reaction in the intestine. Practically all the protein is absorbed from the gastro-intestinal tract, particularly when the milk is boiled. With raw milk large casein curds escape digestion, but with boiled milk very little nitrogen leaves the body by way of the stool. And this nitrogen does not necessarily have to come from the protein of the food, but may come also from the protein of the intestinal juices, of the intestinal bacteria, and of the intestinal epithelium. Once past the digestive tract and into the body, this food has three important duties:

*a.* It will replace protein that has been lost from the body.
*b.* It supplies substance to the tissues to satisfy growth.
*c.* It can be used by the tissues for energy.

It is interesting that the amount of protein retained in the body does not depend markedly upon the amount offered, the child retaining approximately the same amount of nitrogen whether fed on the low protein breast milk or the high protein cow's milk. When protein leaves the body, it is excreted practically entirely through the urine. About 60 to 80 percent of it appears as urea and the remainder as ammonia and other waste-products.

### FAT

Like protein, fat digestion begins in the stomach. There perhaps 25 percent of it is split up, the rest being digested by the ferments of the intestine. Unlike protein, however, some fat normally appears in the stool. Whether this fat has been taken into the body and then excreted into the large intestine, or whether it simply passes along the intestinal tract undigested, we do not know, but the fact remains that approximately 1 to 10 percent of the fat taken by the baby will reappear in the stool. This fat is not necessarily in the same form as it was when the baby drank it. It may appear in three different ways, and these ways, gentlemen, I urge you to note, because we shall hear of them later. It may exist as:

(1) Ordinary neutral fat. This is the simple fat that was in the milk.

(2) Fat-soaps. I won't bother you with the chemistry of the formation of soaps, but in a crude general way remember that fat, when it joins *alkalis*, such as calcium and magnesium, forms a soap. This is not the absolutely correct chemical combination, but it will suffice.

(3) Fatty acids. These, in contrast to soaps, are simply fat in combination with an *acid*. Again, this is not strictly chemically correct, but it will do.

So you see when the intestine is alkaline, soaps are formed, and when the intestine is acid, the soaps disappear and the fat becomes changed to a fatty acid.

Most of the fat that passes the digestive tract is either burned

in the body or else is stored in the subcutaneous tissues and the liver. Fat, in contrast to protein, is not an absolute essential to the diet. Some babies thrive on buttermilk or on skimmed milk, with practically no fat. However, clinical observation would suggest that these children have a lessened degree of immunity to infection than those on higher fat diets.

## CARBOHYDRATES OR SUGARS

In taking up the subject of carbohydrates, we consider perhaps the most interesting element of food. Carbohydrates exist in nature in three different forms:

(1) Complex carbohydrates, of which starch is an example.

(2) Less complex forms, known as disaccharids, of which lactose (milk-sugar), saccharose (cane-sugar), and maltose (malt-sugar) are examples.

(3) Simple forms, of which glucose or grape-sugar is a good illustration.

It is interesting that the body can use carbohydrate only in its simplest form, viz., that form which glucose represents. If we should inject a solution of lactose (milk-sugar) under the skin, this very same lactose would pass right through the body, would be absolutely untouched by the body tissues, and would be excreted in the urine as lactose. This holds true for practically all the other more complicated sugars, with the one exception of maltose. In some mysterious way the cells of the body seem to have the faculty of using maltose. So you see that the process of digestion of carbohydrate is simply a means by which more complicated sugars are split down to the simple ones—a means to adapt all forms of carbohydrate to the use of the body tissues. In this splitting process, we should remember the different stages through which a complex carbohydrate like starch passes. The first product is a substance called dextrin, which is very much like thoroughly browned flour. The next step is the formation of maltose, and the last step, the formation of the simple sugars, such as glucose. That you may have a clearer picture, let me remind you that the simple sugar glucose is composed of $C_6H_{12}O_6$; the disaccharids, meaning milk-sugar, malt-sugar, and cane-sugar, are composed roughly of two

of these simple sugars fastened together, and the complicated carbohydrates, such as starches, are composed of a great many of them bound together in different fashions.

Just as with other food substances, most of the carbohydrate digestion goes on in the intestine. Here simple sugars are formed and practically all absorbed. In the normal baby one rarely finds any carbohydrate in the stool. One exception may be made in a child receiving a large amount of starch. If the starch is not thoroughly digested, it will appear in the stools.

Having passed the intestinal mucous membrane, the carbohydrate enters the blood and is stored in the liver and muscles as glycogen. From these great storehouses the amount of sugar in the blood is kept at practically uniform composition, viz., 0.1 percent. The end-products formed by burning are chiefly carbon dioxid and water. The carbohydrate is practically all burned, and never normally appears in the urine unless very large quantities are given.

It is well to remember that a child has a very great tolerance for carbohydrate, apparently needing much more in proportion to his body-weight than does an adult. Just take this example, for instance: A baby weighing 10 pounds will drink approximately 800 c.c. of breast milk—almost a quart. In this he gets 56 grams of lactose—almost 2 ounces. If we wish to feed an adult weighing 140 pounds the same amount of sugar in proportion to his weight, we would have to feed him 800 grams a day—almost 28 ounces. So you see what need the child has for sugar. Indeed, from the study of infant nutrition and disease we are learning much of the value of carbohydrate and the variety of functions it performs.

*a.* First and foremost, sugars supply energy to the tissues. The baby moves and cries and performs all his daily work chiefly from the energy supplied by the carbohydrate.

*b.* Interesting and not thoroughly explained is the fact that carbohydrate seems to save tissue protein. If we feed a certain amount of sugar, the baby seems to live on this and use up less of his body protein.

*c.* Carbohydrate is related to the fat. If the body is not supplied with enough sugar, the fat of the food becomes poisonous and abnormal split products appear in the urine. When the

carbohydrate is increased, these toxic products disappear. The old German clinician, Naunyn, described this in the striking sentence: "The fat burns in the fire of the carbohydrate." Just remember that sentence, gentlemen, "*The fat burns in the fire of the carbohydrate,*" and you will have a striking picture of fat and carbohydrate metabolism.

*d.* In contrast to fat, sugar *cannot* be replaced. Rosenstern, one of Finkelstein's assistants, in interesting experiments showed that if sugar is removed entirely from the diet, the baby will not thrive, and he proved conclusively that a baby to live must have a definite minimum. So in contrast to fat, sugar is *absolutely essential* to life.

*e.* We are beginning to learn of an important relation that carbohydrates have to water in the body. This point is not absolutely established, some scientists saying that we have not as yet proved our point; but clinical evidence is very strong, and it is on the basis of this *clinical* evidence that I ask you to remember that carbohydrates help the baby retain water. The following curve illustrates the observations which led us to these conclusions (Fig. 1):

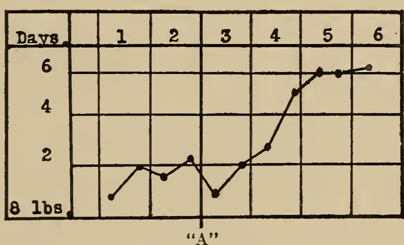


Fig. 1.—(From Langstein and Meyer.)

If, at point "A," one should add a small amount, viz., two to three teaspoons, of a simple carbohydrate, to the bottle, frequently in one to two days the weight jumps up many ounces. How are we to explain this abrupt rise in the curve? A baby cannot gain several ounces from a few teaspoons of food. There is not enough protein, not enough fat, not enough carbohydrate in a few teaspoons to make several ounces. The logical

conclusion is that this gain must be due to water. A child is like a sponge, absorbing water into his tissues and excreting it again very readily. Again, the removal of a small amount of sugar from this diet may lead to a sharp drop of five to six ounces.

*f.* Sugars have an interesting relation to body temperature:

(1) If the body is markedly cooled, glycogen seems to disappear from the muscles.

(2) The following temperature curve will illustrate this from a clinical standpoint (Fig. 2):

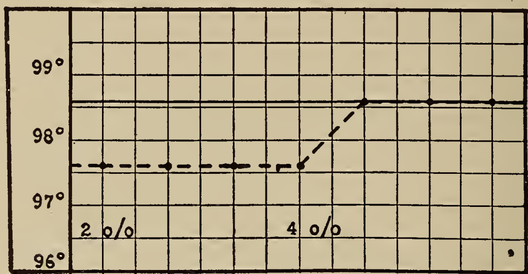


Fig. 2.—(From Langstein and Meyer.)

This child, with only 2 percent sugar in his diet, may have had a subnormal temperature for several days. If we increase the sugar to 4 percent, the temperature may rise to normal.

## MINERAL MATTER

Gentlemen, the *mineral* matter in baby's food has long been overlooked. Indeed, even now the door has barely opened, but visions and dreams perhaps, begin to suggest the coming importance of mineral metabolism. One may almost say that physiologists are learning from the pediatricians. The baby is the simplest of all organisms to study. He is untouched by disease; his food is the simplest of all foods—can be analyzed and absolutely controlled; and to get correctly the total urine and daily stools in twenty-four hours is not a very difficult task. Hence the study of the baby has increased our knowledge decidedly in some of the fields of physiology.

Of mineral matter, breast milk has 0.2 percent; cow's milk,

0.76 percent. You see that cow's milk has almost four times the salt content of breast milk.

Strange that in our studies we have so long overlooked these differences. The splendid researches of Ludwig F. Meyer only relatively recently have been responsible for bringing them to our attention. Like other foods, salts are absorbed chiefly from the intestines. In the body they perform many functions, and then leave through the kidney and bowel. Through the kidneys most are excreted; through the intestines calcium, magnesium, and iron leave. Of course, we cannot say whether the calcium, magnesium, and iron found in the stool have been absorbed into the body and thrown out again, or whether they have simply passed unabsorbed along the child's digestive tract; but we do know that we find these salts in the stool. In passing, let me call your attention to the calcium:

| One Quart | |
|---|---|
| *Breast Milk* | *Cow's Milk* |
| Calcium......0.42 gram | Calcium......1.72 grams |

This preponderance of calcium in cow's milk is an important factor in making the intestine alkaline.

In the normal baby salts have a relation to protein, and for every definite amount of protein that the child absorbs a corresponding amount of salt is retained. This relation is far more definite in the baby on the breast than in the one on the bottle, and in disturbances of the latter often far more mineral is lost than is nitrogen. This improper relation of salt to protein in the artificially fed baby may feature in some of the disturbances.

Gentlemen, I don't want to bother you too much with chemistry, but let me give you one little glimpse into the possibilities of salt metabolism. Suppose we take a simple salt like calcium chlorid; suppose that salt is introduced into the intestine. In the intestine it is split up into calcium and chlorin. We just have learned that chlorin is excreted chiefly in the urine; calcium, in the stool. We may picture this by the accompanying illustration (Fig. 3).

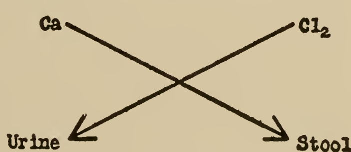


Fig. 3.

Chlorin cannot leave the body alone, but must leave in combination with some other salt, usually sodium. The calcium makes other combinations in the intestines. Thus, feeding a simple substance like calcium chlorid forces sodium out of the body through the urine. This is a simple conception, but see what tremendous possibilities open to us! Just picture to yourselves all the different salts of the baby's diet pursuing their individual courses through his body. See these possibilities! We barely are *beginning* to grasp them. How utterly in the dark are we as to the actual effects upon the child's organism of the complicated mixtures that we are wont to prescribe! We

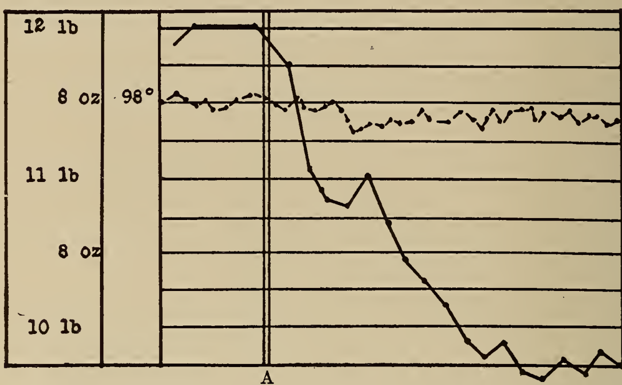


Fig. 4.—Drop in weight and temperature following salt withdrawal. (From Langstein and Meyer.)

are barely at the beginning of understanding the true effects of our simple combinations, and you can see what enormous differences absolutely unknown to us must there be in the effects upon the child's body of the markedly different salt contents of breast milk and of cow's milk.

Like protein, water, and carbohydrates, minerals are essential to life, and removal of them results in rapid death. The fascinating experiments of Jacques Loeb show that not only are minerals absolutely essential to life, but, if they are not present in the body in certain *proportions*, they may exert *toxic* influences. The surgeons make use of these principles in their so-called balanced salt solutions. Like carbohydrate, salts

seem to have definite relation to body weight and temperature (Fig. 4).

The removal of salts at A results in a drop of temperature and a marked loss of weight. The most important of all salts in causing these effects is sodium. Again, in chronic undernutrition, with deficiency of salt in the diet, the temperature may be consistently subnormal, and feeding a child in this stage about a dram of sodium chlorid may cause a marked rise in temperature, with fever.

## WATER METABOLISM

The child's tissues are somewhat richer in water than the adult's. In a quart of breast milk a day,—a quart being equal to 1000 c.c.,—he drinks 885 c.c. of water. Just see the percentage of water in baby's diet,—885 parts to every 1000,—or, to put it differently: an adult uses approximately one-half ounce of water for every pound that his body weighs, while the child uses between two and three—about four times the quantity of the adult. Like the other food-stuffs, water is absorbed chiefly from the small intestine. It is stored mainly in the muscles and normally leaves the body about 60 percent through the urine and about 40 percent through the lungs and skin.

Like carbohydrate, salts have a definite relation to water (Fig. 5).

If, at A, we add a teaspoon of salt to the diet, the baby's weight rises sharply. The inexperienced physician and the happy mother might exclaim: "At last we have found the proper diet! The child finally is gaining!" But, unfortunately, the excretion of this salt is accompanied by just such a precipitate loss as there was previously a gain. The weight comes down exactly to where it was before the salt was added, and now we rather ruefully learn that this great gain was not in true tissue substance, but was only in the water-content of the body.

## MILK IN THE GASTRO-INTESTINAL TRACT

Gentlemen, we have considered the individual elements of the milk. We have studied them in the gastro-intestinal tract; we have followed them through the body; we have seen them

in their excretion. Let us pause for a moment and look at the milk as a whole.

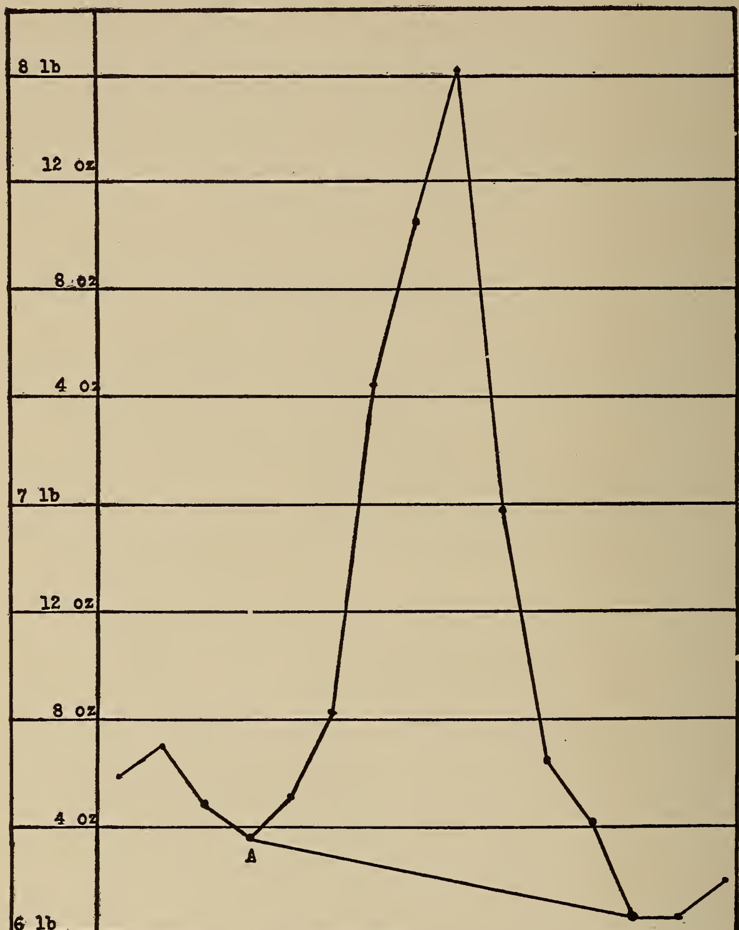


Fig. 5.—Gain in weight following addition of salt to diet. (From Langstein and Meyer.)

In the stomach two important changes take place: the protein, due to the rennet, coagulates, and the milk separates into

curd and whey. You remember that the curd consists of the casein, which, in its formation, ensnares some fat. In this process much of the calcium is dragged out of the whey and joined in chemical combination to the casein; so casein in connection with the base calcium becomes a powerful agent for making the intestine alkaline. The whey, you will remember, represents the water-soluble elements of the milk; *i. e.*, the water, salts, sugar, and the albumins and globulins. This quickly leaves the stomach. The casein curd with the entrapped fat may remain several hours to be thoroughly digested. This interesting little point in physiology explains the uselessness of following the tables which older scientists with great pride and perseverance built for us, viz., feeding the child at definite ages, food in proportion to the capacity of his stomach. As a matter of fact, because the whey leaves the stomach so rapidly we often feed the baby more than one might imagine, and we may disregard entirely these older tables. You see we have at hand a means for hastening or retarding the emptying of the stomach. A mixture high in whey will leave the stomach rapidly; a mixture high in casein and fat will leave slowly, and so, by altering our mixtures, we can greatly influence gastric motility.

In the intestine the milk meets the various digestive ferments. The bile makes the fat soluble. Then the ferments of the pancreas and the intestinal glands, aided by the bile, seize all the fat, carbohydrate, and protein, and tear them down to their fundamental elements. These then leave the intestine.

## THE STOOLS

The above in a very superficial way describes the digestion of the milk. Just what remains in the stool? In the stool are—

*a*. Great quantities of bacteria. I put these bacteria first to impress you with their importance. Up to the present, in infant feeding, these bacteria have been almost overlooked although they may constitute 16 to 18 percent of the stool. You see the possibilities for bacterial action existing in the intestine. Normally, the organisms live only in the large intestine,

the upper intestine being sterile; but, under conditions of which we shall hear later, they leave their home, extend up to the small intestine, and flourish there. Why they normally remain only in the large intestine and do not thrive in the upper bowel is not absolutely known. Some men claim that the duodenum, either by its juices or by the properties of its cells, is able to exert a strong bactericidal influence. Kendall has suggested to me that, due to the rapid absorption of food-stuffs, bacteria may not thrive in the upper intestine, as no food remains for them. Probably both factors are of importance.

In the large intestine two different groups of bacteria exist: those living chiefly on protein, attacking this protein, and causing putrefaction and alkali formation; those living chiefly on carbohydrate, attacking the sugars and causing fermentation and acid formation.

Gentlemen, in the last lecture you heard of the importance of these two processes, fermentation and putrefaction. Just as readily as in the milk that stands at the doorstep, do these activities proceed in the child's intestinal tract; but here we have them perfectly under control. Feeding protein calls forth the putrefactive organisms; feeding carbohydrate calls those producing fermentation. Remember that putrefaction, with resulting alkaline change, slows down intestinal peristalsis and leads to an alkaline, foul-smelling stool. On the other hand, fermentation with resulting acid formation leads to increased peristalsis and to watery, greenish, sour-smelling diarrheal stools. I urge you under no circumstances to forget that *protein putrefies; carbohydrate ferments.*

*b.* Besides bacteria, the stool consists of unabsorbed foodstuffs.

(1) Protein, we learned, rarely appears normally in any appreciable quantity unless raw milk is given.

(2) Fat is concerned somewhat in the actual structure of the stool. Feeding skimmed milk may result in thin bowel movements with mucus and small amounts of solid material; increasing the fat in the diet may give rise to a formed stool. It is the fat in the form of soaps which has most influence on stool structure.

(3) Like protein, little carbohydrate is found normally except

in those cases where much starch is fed, this starch passing down the intestinal tract undigested.

(4) The salts are of great importance. Calcium, for instance, by its insolubility in water, gives bowel movements of dry, alkaline nature.

*c*. Besides bacteria and food substances, there are secondary products. Protein, as you remember, calls forth alkaline intestinal juice rich in albumin. Secondly, any protein that remains in the intestine unabsorbed will be attacked by the putrefactive bacteria, with resulting alkaline products. In the same way any unabsorbed carbohydrate will ferment into acid products. The amount of fermentation of this carbohydrate we can influence markedly by the nature of carbohydrate we use. Bacteria do not attack readily the complicated carbohydrates, such as starches and dextrins. When we feed starch or dextrin to a baby, this carbohydrate is changed by the digestive processes *slowly* to the simpler sugars, and these simpler sugars, as they are formed in small amounts, are absorbed through the upper intestine before the bacteria attack them. Thus complex carbohydrates, such as starch and dextrin, are normally rather constipating. The lower carbohydrates, such as milk-sugar and glucose, are readily attacked. When a child receives a large quantity of one of the latter some of the sugar may reach the region where intestinal bacteria are flourishing, and fermentation, acid formation, and diarrhea result. Clinical observation suggests that the fermentation of these sugars is influenced by different factors:

(*a*) Feeding the baby whey of cow's milk seems to increase the degree of fermentability of the sugar.

(*b*) An increased amount of protein with its putrefying alkaline-forming properties makes the sugar less fermentable.

(*c*) The condition of the intestine is of great importance:

(1) A perfectly healthy, intact mucous membrane will be able to keep bacterial growth under control and prevent a marked degree of fermentation.

(2) A diseased intestine may not be able to combat a fermentation induced by high sugar feeding.

You see, gentlemen, why I am dwelling upon these subjects. The condition of the baby's stool depends *absolutely upon you.*

You have at your disposal the means of making the stool alkaline, constipated, and hard, or acid, diarrheal, and watery. There is no mystery about the process; the explanation is simple; the means are at hand. Feeding a baby high protein, by inducing putrefactive change, by calling forth large amounts of alkaline intestinal juices, by bringing down large amounts of the base, calcium,* in connection with the casein, produces constipated, hard, soapy stools. Feeding large amounts of sugar, by inducing fermentation, with the resulting formation of various irritating acids, leads to diarrheal acid stools. *Don't forget these important factors.*

Just one word about the energy of foods.

## ENERGY OF FOODS

In the science of physics the term "calorie" is used. This is purely scientific, and means the amount of heat or energy required to raise 1 gram or 1 kilogram of water one degree (30 grams are an ounce). The older physicists investigated the energy content of various food-stuffs, and in their investigations learned—

1 ounce of protein represents about 120 calories.
1 ounce of carbohydrate represents approximately 120 calories.
1 ounce of fat represents approximately 270 calories.

This is pure physics. It was due to the investigations of the children's specialist, Heubner, in connection with the physiologist, Rubner, that these physical studies were applied to infant feeding. They showed that a normal baby, to thrive and gain, requires for the first six months approximately 45 calories for every pound of his body weight. For example, a baby weighing six pounds requires about 270 calories. From these studies has

* Since delivering these lectures the writer has read the fascinating work of C. H. Clowes, *Jour. of Phys. Chem.*, 1916, xx, 407, in regard to emulsions. He has shown that the addition of salts of calcium to a mixture of oil in water, as, for example, cream, will promote the change of this mixture to an entirely different type, namely, an emulsion of water in oil, as butter. The author does not know if these studies have as yet been applied to nutritional disturbances. This effect of calcium salts may possibly be equally important, as regards causing constipation, as the effect of calcium as an alkali.

developed the caloric system of feeding first advocated by Heubner and later adopted by many pediatricians. We shall speak of it again.

In conclusion, what points of this lengthy discourse are going to be of value to you in the feeding and treatment of nutritional disease? Remember, first and foremost, the great differences in putrefaction and fermentation; that any protein remaining unabsorbed leads to putrefaction and alkali formation, with resulting hard, constipated stools; that any carbohydrate remaining unabsorbed in the intestinal tract leads to fermentation and acid formation, with diarrhea and watery stools. Remember, fermentation of the carbohydrate is greatly increased by the whey elements of cow's milk and by any diseased or weakened condition of the child's intestine. Normally, due to their gradual digestion, starch and dextrin ferment less readily than simple sugars. Remember, in a general way, the stool content, and that fat in the form of alkaline soaps gives structure to the stool. This is the fat in combination chiefly with calcium and magnesium. Remember that in the stools normally no carbohydrate is present, and that when milk is boiled, no undigested protein is found, thus disproving in a rather general way the previously held idea of indigestibility of cow's milk casein. Remember the functions of the different elements of the food. Protein and salts make up the tissues of the body. Remember what we said about carbohydrate, and that carbohydrate and salts seem to be important factors in pulling water into and out of the baby's tissues.

## LECTURE III

# MODERN CONCEPTION OF DISTURBANCES OF NUTRITION

Gentlemen, in the last two lectures we concerned ourselves with the subject of milk and with the subject of milk and the baby. Today let us start the most fascinating of all studies, the study of the baby. We wish to consider that great, bewildering group of ailing, non-thriving, sick children, some with diarrhea, some with constipation, described by the various terms atrophy, marasmus, malnutrition, inanition, indigestion, gastroenteritis, ileocolitis, cholera infantum, and dysentery. You probably are conversant with the methods and teachings of the eastern schools. My purpose is now to give you the viewpoint of the middle West. In a general way we follow the European ideas. Wishing information from the very source, our younger men have sought foreign clinics, and it is information thus obtained which I wish to convey to you. After you have thoroughly mastered our methods you will be in a position to survey comprehensively the entire field and to make an intelligent decision for yourselves.

A little review of history will be of great aid in understanding the modern developments. Let us return for a moment to the autopsy room in Vienna some twenty or thirty years ago. Vienna, as you know, is almost the home of pathology. Postmortem examination is conducted with the same rigid care and exactness as is clinical investigation. Every patient who dies in the Vienna hospital must come to postmortem. It is natural that with such facilities, the whole Vienna teaching should follow pathological-anatomical lines. Even the clinicians made pathology the foundation of their diagnoses, and it was only logical to attempt to divide this great group of sick children into classes according to pathological findings. In Vienna one might say the conception was as follows:

| The *well baby* was in a group exclusively by himself. | The *sick baby* might be affected with— |
|---|---|
| | *a*. Dyspepsia.<br>*b*. Entero-catarrh.<br>*c*. Cholera infantum.<br>*d*. Follicular enteritis, etc. |

This was the consensus of opinion of the great Viennese pediatricians and pathologists. To them a well baby was a child to be neglected, not to be considered by medical men. The well baby might play in his nursery; be of no interest until he assumed one of the types of disease. These types were described as *local pathological-anatomical* changes in the gastro-intestinal tract. In other words, if the baby vomited, he had gastritis. If he vomited and had a slight diarrhea, he had a gastro-enteritis. If he had a diarrhea with bloody stools, he had ileocolitis or possibly follicular enteritis.

You see, then, that such a viewpoint made a sharp distinction between the well baby and the sick baby. The well baby was uninteresting, but the sick baby, by showing local changes in his gastro-intestinal tract, became very attractive and an object of much study. When it came to putting this classification into *clinical* practice, however, great difficulties arose, and when these clinical pathological diagnoses had been established, autopsy *frequently failed* to confirm them. Clinical pictures often changed. What one day was diagnosed entero-catarrh became the following day cholera infantum. Not even in sharp pictures, such as follicular enteritis, could the ulcerated intestine always be demonstrated. And in many cases showing the severest clinical symptomatology, as, for instance, cholera infantum, postmortem examination not rarely showed absolutely no change in the digestive tract other than perhaps a slight reddening of the mucous membrane.

Slowly the pathologists became discouraged. Gradually they lost their interest in seeking pathological foundations, and now, if one goes to Vienna and stands in the great autopsy room, the lack of interest shown in the postmortem examination of infants is impressive. While great groups of men crowd around the tables seeking knowledge from the carefully, accurately con-

ducted autopsies of adults, dead infants are often absolutely neglected—*not even examined.* When one asks the busy professor why such and such a child is not autopsied, the answer is a shrug of the shoulders and "What's the use? We never find anything." This mute evidence from the anatomy room of Vienna speaks for the utter failure of pathology to provide a classification for these disturbances.

The next attempt was made by the great Vienna pediatrician, Escherich. Not satisfied with pathology, he and his assistants sought etiological factors in *pathogenic bacteria.* Numerous and valuable researches were conducted, but in vain, for no specific microörganisms seemed to produce these clinical entities. When I say "He failed," gentlemen, I do not mean that *he* failed. His service was of *tremendous* importance, because negative evidence is as valuable as positive, and we could proceed only after having learned that our classification could not be founded upon bacteriology.

The next step was taken by that almost romantic figure in pediatrics, Adalbert Czerny, the brilliant Austrian clinician who occupied the chair of children's diseases at Breslau. His great mentality, aided by keen clinical observation, has given the pediatricians of the world the most novel and most useful conception we have yet received. We must forever be indebted to him for introducing the new term, "disturbance of nutrition." In employing this term we already have a premonition of changes that will affect our therapy. This term implies that the child as a whole is affected, rather than exclusively his gastro-intestinal tract. Even though the trouble originates in the digestive organs, even though symptoms may *entirely* be those from stomach and intestine, still *every organ in the body* is affected. What a thought is this, gentlemen, to guide us in our therapy! If the child *as a whole* is affected, we must admit that changes take place in his bones, in his muscles, in his skin, in his complete organism; and already our keen interest in the stool must wane. The stool becomes no longer our sole guide to therapy but merely one of many symptoms.

Czerny was one of the first to doubt the indigestibility of cow's-milk casein. With the doctrine, "Protein can do no

harm," the very antithesis of former teaching, his skeptical brain cast the pediatrics world into furor

Realizing the failures of pathology and bacteriology as aids in classification, he directed his studies from the viewpoint of etiology and gave us the famous Czerny classification. The grouping of "disturbances of nutrition" is according to etiology.

1. Disturbances on the basis of *infection*. These may be of two types:

(*a*) Direct bacterial infection of the child.

(*b*) Milk or food spoiled by bacterial action.

2. Disturbances on the basis of *constitution*.

3. Disturbances on the basis of *food*. Of these, Czerny described two clean-cut clinical entities:

(*a*) The condition which he called "milk injury," namely, a rather pasty, flabby child, not very sick, but not thriving, and very constipated. Czerny thought the etiology of this condition to be *high fat feeding;* and so, though he gave the name "milk injury," he really meant "fat injury."

(*b*) The condition he called "starch injury," a little emaciated, weak, undernourished baby, who has received an exclusively one-sided starch diet.

Czerny's immeasurable contribution in this classification was the introduction of *food factors*, in the causation of a *clinical picture*. For the very first time we hear and think of a sharply defined, clearly described disease being due to nothing other than the food *we* offer the baby—perfectly good wholesome food, but mixed in improper proportions. What a tremendous difference in our viewpoint results as regards our conception of the well baby! What Czerny has done is to impress upon us that the well baby is not necessarily well, but by a little one-sided feeding can be brought right over into the group which we had reserved entirely for the sick. Like this (Fig. 6):


Fig. 6.

In this study Czerny limited to two the clinical types which improper feeding could produce, namely: the pasty, constipated child resulted from fat, and the emaciated, undernourished one from exclusive starch. The diarrheal diseases he believed due either to definite intestinal infection or to milk spoiled by bacterial action.

Contemporaneous with Czerny, Finkelstein in Berlin was making remarkable *clinical* studies. Perfectly independently these two men worked, Czerny seeking the *causes* of disease and Finkelstein describing *clinical* pictures. Not by theorizing, not by hypothesis, but by careful observation at the bedside, sitting with his little patients by the hour, studying them with the care of a scientist in his laboratory, did Finkelstein arrive at conclusions which threw the already perturbed scientific world into chaos. The opportunities for clinical investigation in Berlin are enormous. Many great institutions care for the large number of illegitimate children that exist in that city. Finkelstein's alone has over 300 beds for infants under two years of age. Studying and observing such infants are, of course, much simpler than in private practice, or even in ordinary hospital work. Many great men are in charge of these institutions, many have had the same opportunity as Finkelstein; but none had the great clinical insight and judgment to accomplish what he has.

His studies were of a purely clinical nature. He saw that some children had diarrheas; some had constipation; some had fever, some subnormal temperature. In some the pulse was markedly accelerated; in others it was slow, feeble, and irregular. In some respiration was increased, rapid, and deep; in others it was slow and weak. In some the urine was full of sugar, albumin, and casts; in others it was perfectly normal.

Varying from the velvety pink of the normal to the inelastic, flabby, *mud*-colored tint of the child in disease, the skin seemed subject to infinite variations and change. So was it with the muscles, some being normal, some rigid, some flabby.

In one type of child with evidence of great cerebral involvement consciousness was markedly disturbed, and in another the sensorium was perfectly free.

In these clinical studies Finkelstein brought out one fact, the importance of which long had been overlooked; namely, the child's *weight curve* (Fig. 7). To make a weight curve one must weigh the baby every few days, preferably every day, and plot out a curve upon a tabulated sheet, as one does for temperature, pulse, and respiration, or just as simply conceive it in the mind. These studies showed that weight curves were diagnostic of definite clinical entities. He called attention to the curve of the healthy breast-fed baby, gaining steadily, the gain each day being like the one previous. He

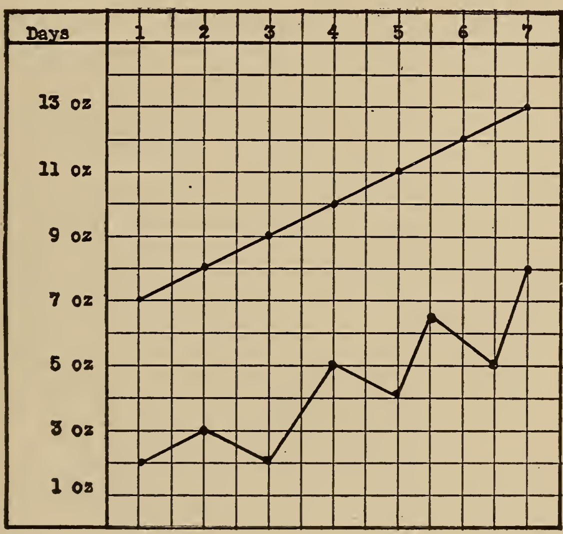


Fig. 7.

reminded us of the zigzag curve of the bottle baby, and suggested that this irregularity was due to the irregular retention and excretion of salts. You remember that cow's milk is richer than breast milk in mineral matter, and that being concerned in the retention of water in the baby's body, salts markedly influence the weight.

He showed a curve characterized by cessation of gain. He showed a curve characterized by gradual loss. He showed a curve characterized by acute severe loss. And, lastly, he showed the curve of a chronically sick baby, sick for weeks or months.

These four curves (Fig. 8) are typical and practically diagnostic of four distinct types of cases, each one of which might be produced through improper feeding. His entire classification is a comprehensive one, but for the present let's confine

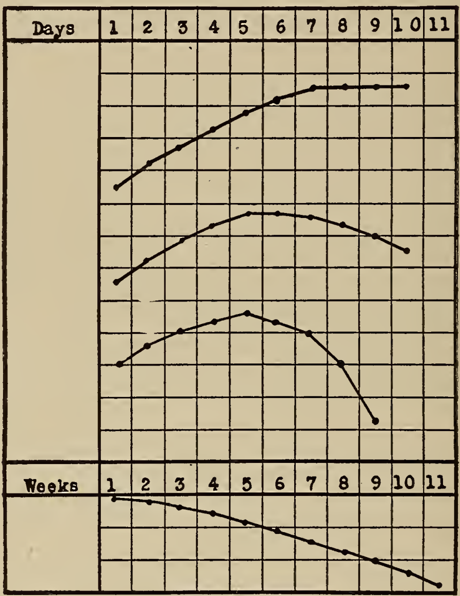


Fig. 8.

ourselves to this group which Czerny first introduced and Finkelstein so greatly enlarged, namely, "Disturbances of Nutrition" on the basis of food. Why Finkelstein was not satisfied with *etiology* as a means of classification he explains in his modest way by saying: "We are still in such a maze that it might perhaps be wiser, as a guide to us in further study, for the present to content outselves with clinical pictures. *The truth is always to be found at the bedside.*" His classification of food disturbances is as follows:

1. *Failure to Gain.*—Infants who, though not very sick, are not thriving nor gaining as they should. They usually have constipated, soapy stools and are subject to infections.

2. *Dyspepsia.*—Here the picture is that of a mild diarrhea. The child is not very sick, but is a little peevish and irritable—the type which you gentlemen would call a mild gastro-enteritis or a mild summer complaint.

3. *Intoxication.*—This is a very sick child. Diarrhea is marked; loss of weight, rapid and severe. Consciousness is disturbed, and the temperature high. It is much the same picture that you gentlemen, I presume, would call a very severe gastro-enteritis or a cholera infantum.

4. *Decomposition.*—In this condition the child has been *chronically* ill with feeding difficulties. Nothing has agreed with him for weeks. He shows the great emaciation and undernourishment of which the terms atrophy, malnutrition, and marasmus are descriptive.

Not only are we indebted to Finkelstein for this beautiful new clinical classification, but we owe him everlasting gratitude for introducing into the study of disease a new food factor. Czerny introduced fat, and thought overfeeding in fat brought on milk injury, with its associated *constipation.* Finkelstein, with this same viewpoint, studied sugar, and it was his idea that overfeeding in sugar produced *diarrhea.* What a startling new conception this was! When he described to us the severe picture of intoxication, which you would call cholera infantum, and laid the cause of this hitherto deadly, often mysterious disease, simply to excess of sugar in the feeding, the interested profession was stunned, amazed, and unbelieving. In rapid succession, from all parts of the world, seeking to confirm or to disprove this view, innumerable new investigations and experiments were started, and although many of the original theories have been modified, the infinite value of this fundamental observation impresses us ever more and more.

The third invaluable contribution of Finkelstein was the grouping of these four types under the head of "disturbances of nutrition." Like Czerny, when Finkelstein studied diarrheal disease and noted the changed pulse-rate, the changed respiration, the changed temperature, the disturbed consciousness,

and, above all things, the variable and impressive weight reactions, we readily can imagine his reasoning: "Certainly this disturbance must be one involving more than the digestive canal. No matter, even though the origin be purely gastro-intestinal, if every function of the body is involved and affected, we must think of the child as one in whom the *entire nutrition* is changed, and certainly such change must have great influence upon our treatment. Under no circumstance must we think of the gastro-intestinal tract alone." This viewpoint has been inestimable in directing our therapy away from the child's stool to that of the child's *body*. We believe that the stools are valuable *symptoms* of disturbance of the gastro-intestinal tract; but viewing our little patients from the broad conception of "disturbance of nutrition," after having noted the symptom of the stool, we often neglect it entirely, considering it only in its relation to the *entire clinical picture*.

According to the viewpoint of Finkelstein, the grouping of *diarrheal* diseases as "disturbances of nutrition" must make stool examination absolutely incidental to the examination of the entire baby. The symptom of the stool sinks into insignificance beside the symptom of the baby as a whole. The one symptom representing *the baby* is the *weight*. The stool is a symptom to be considered, it is true, but not to be followed blindly. The *weight* becomes our index for treatment.

Finkelstein *did not* deny as a factor the influence of constitution, which Czerny had suggested, nor the importance of infection; but he believed, first and foremost, that most disturbances were due not so much to constitution, not so much to infection, as to *food;* and when we say food we mean perfectly wholesome, good fresh cow's milk, given to the child, however, in improper dilutions. Whether one follows Czerny or whether one follows Finkelstein is immaterial. Both men have done the world a service for which generations to come must be grateful. From the point of view of the clinician the Finkelstein classification is perhaps more practical.

A crude illustration might make clearer the methods of these two men. Suppose we lived two hundred years ago, when disease was considered due to evil spirits, to witchcraft, and to demons. Suppose at that time that out of the bewildering mass

of ailments some great mind had become inspired with an idea of infectious disease, and to the eager world had exclaimed: "Some of these conditions are in a distinct group. They are 'infectious diseases,' and exist as three types:

"Those from pneumococcus.
Those from streptococcus.
Those from meningococcus."

This is what Czerny did some ten years ago when, out of the bewildering mass of ailing infants, he saw "disturbances of nutrition" and said they could be divided into three groups:

Those due to constitution.
Those due to infection.
Those due to food.

Finkelstein, on the other hand, had he lived two hundred years ago, when the above hypothetical individual had discovered "infectious disease," would have said: "I certainly agree that there is a great group of diseases due to infection. We know so little about them, however, that I think we had better stick to the clinical pictures and later we can worry about the causes." He then might have described, for example:

Pneumonia.
Meningitis.
Septicemia.
Rheumatism.

He would have agreed that these pictures might each one be due to the pneumococcus, streptococcus, or meningococcus, but wouldn't have committed himself definitely. In the same way the Finkelstein classification recognizes "disturbances of nutrition" and shows four clinical pictures:

1. Failure to gain.
2. Dyspepsia.
3. Intoxication.
4. Decomposition.

He accepts the etiological factors offered by Czerny—constitution, infection, and food; but the advantage of his viewpoint is that he leaves the field more easily opened for further additions as to etiology.

Either classification is correct. It makes no difference which you follow; but from the clinical aspect the Finkelstein idea is perhaps more practical, for it resembles our clinical classification of infectious disease. As clinicians, what we seek first is a *clinical* picture. When we go to the bedside we do not ask ourselves, "Is this a disturbance due to pneumococcus or streptococcus or meningococcus?" but we do ask, "Is this a pneumonia or a septicemia or a meningitis?" And having established that, *then* we seek the etiological factors. The beauty about a clinical classification is that it is *true*. Theories may be altered, ideas changed, new explanations advanced, but "in the clinic lies the truth."

Having clean-cut clinical pictures, we are in a better position to seek causative factors. Just as in septicemia we have learned that much the same picture may be due to pneumococcus, streptococcus, or influenza, so can we amplify these clinical types of Finkelstein. This classification I, myself, do not believe to be the last word. I doubt if it will stay with us permanently; but it will be of invaluable help in further study.

Having recognized these four clinical types, Finkelstein himself began to seek causes—to fill in the subheadings. Stimulated by Czerny's description of fat injury and by his own discovery of the diarrheal effect of sugar, he attempted to place all four of these clinical pictures upon a food basis. In a crude way one might say his *first* idea was as follows (Fig. 9):

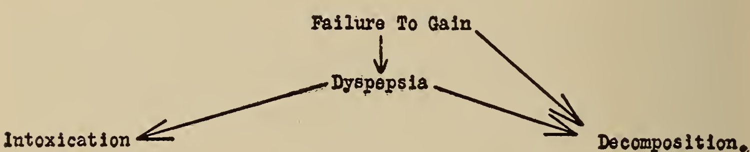


Fig. 9.

Failure to gain was due either to *insufficient food* or to *overfeeding with fat*. The latter was the very same condition that Czerny described as "milk injury," Finkelstein's term, however, for reasons which we will discuss later, was "disturbed balance." Continuance of the overfeeding with fat led to the decomposition stage. Overfeeding with sugar led to the stage

of dyspepsia. If the overfeeding with sugar were continued in the stage of dyspepsia, intoxication resulted. If the mistake was overfeeding with fat in the stage of dyspepsia, decomposition resulted.

This viewpoint has been greatly modified. The hundreds of studies all over the world, stimulated by the novel idea, have brought great light. The all-important result of this first idea of Finkelstein was to bring the well baby and the sick baby closer together. The well baby can now no longer be secluded in his nursery, independent of all interest, only to come to notice when he shows abnormal symptoms. The well baby may at any moment, due to a little improper feeding, enter the group of sick babies. Let me impress upon you gentlemen, that Finkelstein *did not* deny infections as a factor, *did not* deny constitution as a factor; but of all things he did impress upon us the very, very great importance of food, and he attempted to show that many of the clinical pictures of even the very worst diarrhea were due, not to external influence, but to the milk mixtures which *we ourselves* were feeding the baby. This, of course, has been of unspeakable importance in guiding our therapy and stimulating us to deeper thought.

Finkelstein's idea as to the importance of food has undergone, during recent years, considerable revision. Continued studies from all parts of the world have introduced new and reëmphasized old factors. Now we recognize many influences other than food. Finkelstein's latest classification is as follows:

A. Food.

- I. *Perfectly good, wholesome food, i.e.,* pure, fresh cow's milk.
  - (*a*) *Overfeeding.* This may be of two types:
    1. *Too great quantity.*
    2. *A preponderance of one of the elements of the milk, too much fat or too much sugar*—the group which Czerny and Finkelstein called so strikingly to our attention.
  - (*b*) *Hunger.* This may be:
    1. *Insufficient total quantity.*
    2. *Insufficiency of one or more elements of the milk,* as protein and salt deficiency in prolonged use of barley water and gruel.

II. *Spoiled milk and food.* The factor to which Czerny ascribed diarrheal disease, the one which Finkelstein considered unimportant as compared to sugar in the diarrhea of nurslings. Both observers admit the importance of spoiled food in diarrheas of older children.

B. UNDERLYING WEAK CONSTITUTION, or any factor weakening the constitution, such as heat, is an influence of no small importance.

C. MILDER INFECTIONS, such as coughs and colds, bronchitis, and cystitis, are important predisposing agencies.

D. NURSING injuries may be of two types:

I. The failure of the *individual* nurse in allowing her charge to suffer from improper care, from uncleanliness, from overclothing, overheating, or exposure.

II. A weakness inherent to our hospitals is the infant ward. Here one nurse, no matter how efficient, is in charge of several babies. She cannot give each child the necessary individual care. She cannot take proper interest in the preparation of the bottles, nor give personal attention during feedings. The children, suffering from lack of exercise, resemble plants rather than animals, and each day approach more closely the danger of a disturbance of nutrition.

## DIAGNOSIS

How do we diagnose a nutritional disturbance? Besides careful physical examination, we have two valuable aids:

1. *A careful history.* Information of frequent digestive disturbances, of frequent infections, improper care, a weak constitution, or backward development, would lead us to think strongly of nutritional disturbance as a factor in the present complaint.

2. Above all things, gentlemen, never *neglect*, and learn to *know*, the reactions *to food* and *to hunger*.

(*a*) In one child with severe diarrhea the addition of a full bottle of food may be fatal, the child dying, with a rapid loss of weight and with the severest symptoms of intoxication. In

this same child, the complete withdrawal of food for twenty-four hours seems to effect a rapid, striking improvement. It was, in a way, this so-called *paradoxical reaction* that first led Finkelstein to the careful study of food in these diarrheal conditions. Addition of food kills: withdrawal of food saves. What better clinical evidence can we demand of the vital importance of food?

(*b*) In some children complete withdrawal of food for twenty-four hours leads, with all symptoms of collapse, to rapid loss of many ounces of weight and death.

Of these clinical pictures, of these weight curves, of these food reactions, we shall hear more.

To conclude, we have learned this morning that in the great group of non-thriving children, the children with diarrhea, the children with constipation, pathological examination of the intestinal tract as a means of classification is of little aid. We have learned that the science of bacteriology helps us but little. Czerny, with the conception of "disturbance of nutrition," takes our attention away from the intestinal tract, makes us think of the baby as a whole, and Czerny does us an infinite service by doubting the danger of protein and first calling to our attention the importance of food (of fat) in the production of the clinical picture of non-thriving, constipated children. Finkelstein, in a way following the footsteps of Czerny, arriving at these conclusions through careful clinical observation, impresses us with the importance of *all* foods in causing these disturbances, agreeing with Czerny in some respects as to the effects of fat, and doing us immeasurable good in calling to our attention the diarrheal effects of sugar. Laying lesser stress upon constitution and infection in the production of these diseases, he believes disturbances of nutrition almost exclusively to be due to *food*—perfectly good, wholesome milk, but given in improper amounts and diluted in improper proportions. We can never be sufficiently grateful to him for placing diarrheal diseases also under the term "disturbance of nutrition."

This magnificent conception is of inestimable value to us in the treatment of our children. From this viewpoint the stool becomes a symptom, the baby as a whole becomes the important consideration. The stool becomes absolutely subservient to the whole clinical picture. Just think what this means! This

means we must *never* devote ourselves to the intestine alone, but only the intestine in relation to the *whole body*. In our deeper interest in the child's body we may be forced to do what seems to be worst for the intestinal tract. This viewpoint impresses upon us finally, irrevocably, the tremendous importance of the weight curve. The *weight curve* expresses the condition of the baby as a whole; the stool, only that of intestinal tract.

With this conception of the fundamental importance of food, the *well* baby becomes a *sick* baby. The well baby may assume *any clinical* picture by varying his feeding. Gentlemen, if you will remember this, if you will only see your well babies more often, if you only will think of them as sick babies, will treat them with the same care and consideration that you would a patient with infectious disease, I can assure you that you will have little trouble with the babies, little trouble with the mothers, and the feeding cases in your practice will become a pleasure rather than a burden.

LECTURE IV

## FAILURE TO GAIN

Gentlemen, you remember in our last lecture we spoke of the viewpoints of the various great pediatricians. We told of the failure of the Vienna school to place nutritional disease upon a definite pathological-anatomical basis. We spoke of the failure of Escherich to find specific bacterial causes. Don't misunderstand me, gentlemen; the *ideas* failed. The men succeeded. Patient, conscientious perseverance cleared away the obstacles that otherwise would have prevented the advent of newer conceptions. You remember it was Adalbert Czerny, the skeptic, the keen observer, the deep philosopher, who gave us newer thoughts. You remember he no longer spoke of disease of the gastro-intestinal tract. To him these disturbances were "disturbances of nutrition." The baby no longer was diseased solely in his stomach and intestines, but changes were effected in every sinew and fiber of the body. It was Czerny who, for the first time, cast doubt upon the orthodox idea of the indigestibility of cow's-milk casein. It was Czerny who, for the first time, called to our attention the factor of food in the production of definite clinical entities. With two clean-cut clinical pictures he brought to our notice fat and starch. Too much fat was the causative factor in non-thriving, constipated infants; too much starch produced another clinical entity. It was Czerny who gave an etiological classification. You remember the classification? Nutritional disturbances were those—

*a*. On the basis of constitution.

*b*. On the basis of infection; these were the diarrheal diseases. Two factors might be concerned:

(1) True infection of the gastro-intestinal tract with germs of specific diseases, such as dysentery or cholera.

(2) Poisoning, resulting from the drinking of spoiled food—food which had not properly been cared for and had become a great culture-medium for the common every-day organisms.

*c*. Disturbances due to food:

(1) Milk injury.

(2) Starch injury.

So, if we follow Czerny, we no longer speak of gastritis, gastro-enteritis, and cholera infantum; but rather of a disturbance due to constitution, due to infection, or due to food.

In *a* and *b* he gave us etiological factors; in *c* he gave us an etiological factor with two beautifully described clinical pictures.

You remember while this epoch-making work was being evolved, Finkelstein, in Berlin, was making great studies from a purely clinical viewpoint.

In today's lecture I wish to discuss with you Czerny's "milk injury" and show how this has been modified by *clinical* observation.

Czerny's description roughly is as follows: A mother brings her infant, complaining that he is not thriving and that he is very constipated; she doesn't regard him as being sick: just wants a little advice. You, doubtless, have seen many such cases. Upon examination you find a rather pasty, not badly nourished, somewhat anemic-looking child. He is a little flabby. You think of a beginning rickets; you place him upon the table and he flops over, showing a somewhat flaccid musculature. His weight is slightly below normal. Upon questioning the mother you learn that he is not gaining as he used to; that he is a little peevish and fretful; he is subject to mild infections; and, above everything else, the mother dwells upon the constipated, dry, crumbly, soap-like stools, which characteristically do not adhere to the diaper, but easily can be brushed away. To the mother the chief trouble is *constipation*.

You think the child is undernourished; you increase his diet; but he doesn't gain. Possibly he becomes more peevish and irritable, and the constipated stools more persistent.

In seeking the cause of this condition, Czerny focused his attention sharply upon these abnormal bowel movements, and here he made a great discovery. You remember in our second lecture we spoke of the way in which fat normally leaves the

intestine; that a certain amount of it—a rather small percent—combines with alkalis, such as calcium and magnesium, and leaves in the form of soap. To Czerny's great interest, these stools contained a much greater percentage of soap than stools of normal babies. If the soap in a normal baby was perhaps 20 percent of the fat of the stool, in these babies it might be 50 percent. Czerny's reasoning was clear and simple. If a soap consists normally of fat combined with calcium or magnesium; if the stools of these children contain an increased amount of soap, then from these children there must be an excessive excretion of mineral matter, of calcium and magnesium, and the general symptoms might be explained as a disturbance of nutrition in which loss of mineral matter plays a prominent part. If the mineral matter combines with fat to form soaps, then by reducing the fat in the diet we should decrease soap formation and thus lessen mineral loss; by increasing fat in the diet, we should enhance soap formation and increase mineral loss. True enough, Czerny's assistants, by offering these children increased quantities of fat, were able to increase soap formation and cause greater mineral excretion. The solution to the question was now simple. All that was necessary was to diminish the amount of fat in baby's bottle, substitute some food of equal caloric value, and the child should thrive. To accomplish this, Czerny used a mixture known as Keller's Malt Soup, which is made as follows:

(*a*) To one-third of a quart of milk add 1 ounce of ordinary flour.

(*b*) In another mixture, to two-thirds of a quart of water add about 3⅓ ounces of malt soup extract. In this country the latter is put up by Borcherdt or the "Maltine" concern.

(*c*) Add the two mixtures together, boil, and you have in the resulting food an absolute cure, a perfectly ideal treatment. The baby's constipation subsides, the stools become normal, he gains in weight, and in every way becomes brighter and happier.

The following curve, taken roughly from the text of Czerny and Keller, illustrates Czerny's idea (Fig. 10).

This child is five months of age. From birth he got nothing but milk and water, and was brought to the clinic for typical symptoms of milk injury. He did not sleep well, was restless,

and showed the constipated, fat-soap stools. During the first half of February he received one-third milk; during the latter half, half milk, and during March, full milk. Notice here a slight rise in the curve, but it is not sustained. In April Keller's Malt Soup resulted in the astonishing rise. This Czerny attributed to reduction of fat.

In taking up this subject I hesitated somewhat. Would it be wiser to go into detail, showing you the reasoning of these observers, or to state simply that "The symptoms are so and so, the treatment so and so." Upon consideration, however, I thought I should like to show you the fundamental "why" at

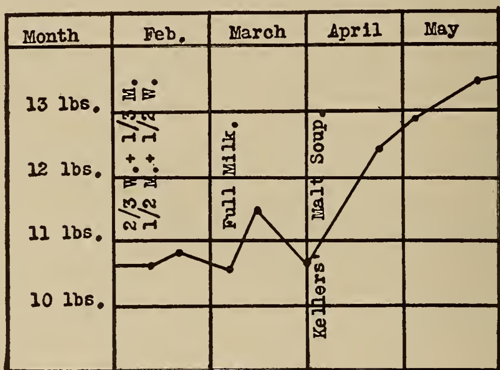


Fig. 10.

the basis of these observations, because if you master the underlying principles, you will have the key not only to the treatment of this particular condition, but also to many of the cases of constipation which perplex you in your daily children's practice.

While these brilliant experiments were being conducted in Breslau, Finkelstein, in his institution in Berlin, was attacking the problem by careful study at the bedside, by accurate clinical observation. Perfectly independently he studied a great group of children, many of whom apparently were not very ill, all of whom showed a "failure to gain." In some, marked constipation was present; in others, bowel movements were more nearly normal. In these studies, Finkelstein and the men influenced by

his teaching, showed that there were many factors featuring in the etiology.

(1) Some children who showed the typical picture of Czerny's "milk injury" were getting insufficient food; increase of quantity brought correction of the intestinal symptoms and speedy cure. This, strictly speaking, does not belong to the group we are discussing. I place it here, however, as did Finkelstein, for from a clinical standpoint in your practice you frequently meet such cases. In true "milk injury," as described by Czerny, increase in total food volume does not result in gain.

(2) Some children recovering from ordinary infections showed this very same symptomatology. They had been thriving perfectly until taken ill with a cough or cold or mild cystitis, and upon recovery, with absolutely no change in diet, spontaneously developed this disturbance. Here, then, fat alone or even the food, could not be blamed, for the baby previously had been gaining on the very same mixture.

(3) In another group improper care of the baby, whether in the home or in the hospital, in some mysterious way seemed to predispose. The explanation is not as yet clear. You remember we are confining ourselves to clinical observation.

(4) A group of children who suffer with a weak constitution, congenital heart disease, or other hereditary anomalies easily progress to this condition.

(5) Lastly, the group in clean-cut, definite form in which too much milk, or, as Czerny would have it, too much fat, seemed to be the important factor.

Gentlemen, you already see what tremendous influence clinical observation exerted upon our interpretation of this condition. Czerny gave us the wonderful conception of disturbance of nutrition; then temporarily forgot it in his intense interest in the baby's stool, and overlooked other factors, perfectly independent of food, which might have been concerned. Finkelstein and his students, in adhering to the broader conception, the *original* idea of Czerny, regarding the stool purely and simply as a symptom and not as a cause, were able to add much to our knowledge.

Let us return for a moment to group (5), the cases in which both Czerny and Finkelstein noted a rather high amount of fat in the

diet. The many observations and experiments stimulated by Czerny's novel conception began to bear fruit, but as time progressed these observations and experiments gradually began to speak *against* the primary influence of fat. First was shown that in some cases, in spite of a high fat diet, in spite of the fat-soap stool, there was no *total* mineral loss to the body. True, the mineral matter in combination with fat was increased, but the mineral matter excreted in combination as salts was decreased, and so the sum total was not above normal.

A second argument against the primary importance of fat was the brilliant metabolic work of young Hans Barth, whose tragic death in the present war has been such a sad blow to modern pediatrics. He and his coworkers showed that in many cases the total amount of mineral matter lost in the form of calcium and magnesium was *infinitely greater* than could be explained by the soap formation in the stool.

And, lastly, comes the ever-valuable, unexplainable clinical evidence that children with well-developed, perfectly typical milk or fat injury can be cured in striking fashion *by the use of breast milk.* Breast milk, as you remember, contains the very same amount of fat as cow's milk. This is an unanswerable argument. If a baby showing the picture of milk injury on cow's milk feeding can be cured at once by the use of breast milk, then fat exclusively, by itself, can scarcely be the sole factor in the etiology. We, blindly groping for explanation, must conclude that fat alone cannot be responsible, but fat plus some invisible mysterious element contained in cow's milk and not in breast milk.

During the furor accompanying Czerny's discovery and the battles waged by his supporters and his critics, Freund was making brilliant, almost conclusive, experiments in his own institution. He fed babies showing the typical picture of milk injury various foods, such as starch. This had little effect upon the stool. He fed them sugar of milk and malt extract. Lo and behold! under the influence of the latter articles of diet the soaps disappeared; the fats were excreted in other combinations, and constipation was cured. This observation seemed uncanny—full of mystery. What could be the underlying principle? Freund explains it in what seems very beautiful, simple reasoning.

Gentlemen, you remember in our previous lectures we dwelt upon the processes of putrefaction and fermentation. We spoke of the alkali-forming protein, of the rather non-fermenting higher carbohydrates, and the fermenting acid-forming lower carbohydrates. The substances which were of great influence in correcting the constipated stool were those aiding fermentation, those tending to make the intestinal contents acid; and now Freund reminds us of a simple little chemical process which previously had been overlooked, viz., that fat does not readily form soaps in the presence of acids, but in a way *combines with them* to form the so-called fatty acids. Soaps in the presence of acids are completely split up, just as if they were salts. Gentlemen, do you grasp the importance of this contribution of Freund? Think of it carefully for a moment. If this be true, soap formation is a result and not a cause. Soap formation is simply a symptom of the intestinal reaction and not a factor affecting it. Feeding substances like protein, which alkalinize the intestine, favor soap formation and constipation. Feeding substances like carbohydrate, which make the intestine acid, break up the soap formation, and cause the looser type of bowel movement. Gentlemen, I urge you to give this matter careful consideration, to hold the principle before you at all times, because in mastering it you have mastered one of the great causes of constipation in infants. "*Fat in an alkaline intestine forms soaps; in an acid intestine, fatty acid.*"

And now, if this great mass of careful observation and scientific experiment proves to us that the constipated soapy stool is an effect and not a cause, are we any closer to a clearer understanding of the picture of milk injury? With true American lack of respect for dignity and title one day I assailed Finkelstein in a corner of his great institution, from which the modest little man could not escape, and asked him to make the matter clear to me. I never left him until, filled with wonder and admiration, I had obtained his own personal viewpoint. He reminded me that in feeding a baby we must consider the *food*, the *intestine*, and by all means that factor which so frequently and at such tremendous cost is overlooked by men speaking exclusively of "gastro-intestinal disease" rather than "disturbance of nutrition,"—*the needs of the child's whole body*. He re-

minded me that in feeding Keller's Malt Soup one reduces the fat, but at the same time increases markedly the carbohydrate. Simple reasoning, simple skepticism, forces the question, "How does one know that this gain, that this recovery, was due to the *reduction* of fat? Is it not just as reasonable to assume that the *increase* of *carbohydrate* was a factor of equal or even greater importance? Is it not likely that children with weak constitutions, children recovering from infections, children suffering from neglect, need more carbohydrate, more energy, than does the normal baby? Is not the primary consideration in these cases the *demands* of the *child's body* rather than the condition of his digestive tract?" Have you forgotten the striking statement of Naunyn, "The fat burns in the fire of the carbohydrate"? With such a remarkable viewpoint, the condition of the digestive tract fades into insignificance before the primary consideration of *the child's body*. The child's vigor and strength depend upon the amount of carbohydrate offered, and are perfectly independent of the reaction of the intestinal tract. Whether the fat in the stool is excreted in the form of soap or whether it is excreted as fatty acid depends upon the reaction of the intestinal contents. If the contents are alkaline, soaps are formed; if acid, fatty acids result. In Keller's Malt Soup we have a mixture ideal for creating an acid condition in the intestine. Low protein from the dilution of the milk lessens alkali formation; high carbohydrate favors acid. Due to this acid, the fat soaps are split up and constipation corrected; but the great benefit to the child—the gain in weight, the improved tone of the muscles, the returning elasticity to the skin—depends not upon the correction of the stool, but upon the *increased supply* of *carbohydrate* offered to the *needy tissues*.

It was for this reason that Finkelstein introduced the term "disturbed balance." He meant to imply that the primary fault was not one of fat injury, was not one of chronic fat indigestion, as is the viewpoint of so many men, but that the trouble lay in a disturbed balance between carbohydrate and fat, perhaps carbohydrate and protein, the body not receiving enough carbohydrate to satisfy its wants, probably not receiving enough carbohydrate to perform successfully the metabolism of the fat. This viewpoint in a striking way makes clear to us

the brilliant success from feeding of breast milk. Breast milk offers the *body* high carbohydrate; breast milk, with its high carbohydrate and low protein, establishes processes of fermentation in the intestinal tract and cures the constipation.

This viewpoint, perhaps, does not explain *every* case; perhaps some cases really are due to primary fat indigestion; but at any rate we learn much from this conception, and a great group of cases becomes clear. Probably in the majority of cases, as shown by the results with breast milk, the fat is indeed only a secondary factor.

Gentlemen, now you see why I have tried to go into detail. If you have followed me carefully; if you have understood the principles which I am trying to make clear, you have the key to the majority of cases of constipation which you meet.

You see also how modern clinical medicine can never be separated from chemistry, physiology, and the allied sciences. The physician needs them all for complete understanding.

The **diagnosis** of this condition is easy. In practice you will have to distinguish it only from inanition, *i. e.*, hunger; in the latter, an increase of a half-ounce or an ounce to each feeding will result in rapid cure. In the true case of disturbed balance no improvement follows.

**Treatment.**—For the young baby breast milk, which is always the ideal food, is the best treatment. In offering breast milk, let me warn you of a little complication, simple in physiology, ignorance of which, however, may lead to unpleasant results. To illustrate (Fig. 11):

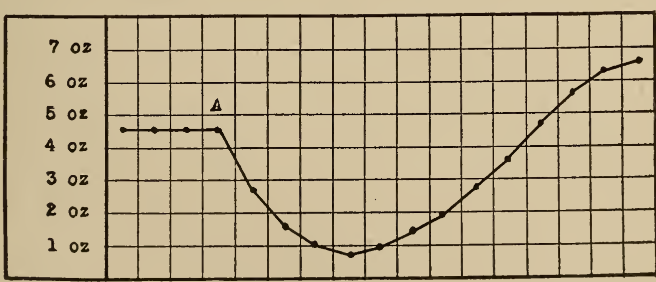


Fig. 11.

At A we have changed the mixture of cow's milk to one of breast milk. A loss of several ounces occurs, lasting several days. What is the explanation? Can any of you grasp why a loss of weight should result from feeding breast milk? The answer is found in the simplest physiology. In our first lecture we told you that cow's milk was much richer in mineral matter than breast milk. In our second lecture we told that minerals, particularly sodium, were important in binding water to the tissues. If our baby had been getting a mixture of three-quarters of a quart of cow's milk, he would be getting 5.7 grams of salt—over a teaspoon. The change to three-quarters of a quart of breast milk reduces his salt intake to 1½ grams. You see what reduction occurs in the mineral matter of his diet. For this reason, until he gets properly adjusted, water leaves the body, with the resulting drop of several ounces in the weight curve. This loss is not due to poor breast milk, is not due to insufficient breast milk, but to perfectly normal breast milk, and a knowledge of the simple explanation will save the mother, the wet-nurse, and incidentally you, much worry.

If artificial feeding is to be employed, what shall be our procedure? Do we need Keller's Malt Soup? No; but we do need the principles upon which it is based. We wish to offer more carbohydrate, more energy to the baby's tissues; we wish and must do this without injuring the intestinal tract. In our next lecture we shall learn that mixtures of high carbohydrate in connection with high fat, *particularly* in connection with *concentrated* whey of cow's milk, are dangerous from the intestinal viewpoint. We, therefore, dilute our milk, not with the idea of diluting the fat exclusively, but of simply making up a mixture which will enable us to offer *to the tissues* higher carbohydrate without causing intestinal complications. We dilute to one-third, adding two-thirds water, and then gradually increase carbohydrate until we get the improvement of the general condition and the more normal stool. Ordinary cane-sugar is the simplest and cheapest carbohydrate to use. One word of warning, however, in employing it. It may become necessary to add more than six or eight teaspoons to a quart of the mixture in order to get the physiological results. Under such circumstances the mother and babe rebel at the sweet taste; therefore,

if it becomes necessary to increase over six to eight teaspoons, it is wise to add some easily fermentable carbohydrate less sweet to the taste. This can be done in the form of the above-said malt soup extract. Don't make the mistake, however, of ordering pure malt extract. This does not mix so readily with the milk, and you may get into difficulties with the mother; but show your superior knowledge by impressing her with the necessity of getting *malt soup* extract. Several concerns put this up.

In children over two or three months of age, remember that one-third milk is not sufficient to provide for continued growth. After a short time one cautiously must increase the concentration of the milk. The increased protein temporarily may cause an alkaline reaction to the intestine with a renewal of soap formation and constipation. This can be combated readily by additional increase of carbohydrate.

One point in the treatment, let me impress you, is what you *should not* do. Now that you understand the underlying principles, you see how utterly unreasonable, how absolutely without scruple, is the physician who *drugs* these patients, treating their constipation with calomel, castor oil, and other cathartics. At our hospital at home Dr. Abt and his associate, Dr. Jampolis, some years ago made interesting observations on perfectly normal babies. Feeding a fine healthy baby a therapeutic dose of these drugs caused the appearance of blood in the stool—not in large quantities, but easily detected chemically. Just think of that, gentlemen; feeding a perfectly healthy, normal infant medicinal doses of calomel produces such irritation in the intestine as to make *blood* appear in the stool! What a crime is it, then, to offer a little child suffering from a condition of disturbed balance these strong intestinal irritants; to try to overcome constipation, not by reason and principle, but by brute force! What this baby needs is not medicine: he needs sugar.

Gentlemen, we are now temporarily going to leave Czerny. Remember his great service to us—his service in giving us the conception of disturbance of nutrition; his service in casting doubt upon the indigestibility of protein; his service in recognizing food as an important factor in nutritional disease. What have we learned from this lengthy, perhaps complicated, discussion? We have learned to *think*. Only the light shed by

time, by distance, by laboratory experiments, stimulated by the keenest clinical observations, could make us change allegiance to Czerny's first idea. Every great pediatrician who was able to read these writings and comprehend them was influenced. The very foundation of pediatrics was shaken. Now, from across the space separating us by years from Czerny's first work we ask ourselves, "Did we not all err alike? Did we not all make the same fundamental error?" We were stirred by the brilliant conception of disturbance of nutrition; we temporarily lost sight of this in our keen interest in one symptom—the stool. In focusing our attention upon the stool we lost all sense of proportion in the discovery of the soap. In this maze of thought we lost sight of the relation of fat to the *other elements in the milk;* we lost sight of the fact that fat in an acid intestine makes fatty acids; in an alkaline intestine, makes soaps. Not that our observations were without value or interest: much good has resulted. But they were in entire disproportion to the great clinical picture. Only careful, frequently repeated, accurate bedside study resulted in putting us again upon the right path. Just as we had forgotten to note the relation of the *fat* to the *other* elements of the milk, so had we forgotten to note the relation of the *symptom*—the constipated stool—to the *main clinical picture.* Just as our exclusive attention to the fat had led us astray, so did our exclusive attention to the stool divert us from our original broad conception of disturbance of nutrition. Gentlemen, what have we learned? We have learned that if we wish to err only slightly, if we wish to have an anchor that will hold us secure, let us never forget that first, foremost, above everything else, the fundamental truth is to be found in careful, conscientious clinical observation and study.

What is the practical significance of this lengthy discourse? If a constipated baby is not gaining upon a well-regulated diet, carefully increase it. If he still does not gain, make up a mixture with a higher percentage of fermentable carbohydrate than was contained in the original formula, and increase gradually this carbohydrate until improvement occurs.

## LECTURE V

# THE STATES OF DYSPEPSIA AND INTOXICATION

Gentlemen, if our last lecture was important from a standpoint of therapy, today's lecture is vital, for it concerns *life*. You remember at our last meeting we spoke of Czerny's new viewpoint, "disturbance of nutrition." We showed how he introduced food as a factor in causing disease and how he laid particular importance on fat. He doubted the indigestibility of protein; he gave us an etiological classification; due to this etiological classification, to this concentration, perhaps, on one causative factor, we became side-tracked and focused too carefully upon one symptom—the stool. Finkelstein, you remember, accepted the viewpoint of "disturbance of nutrition," agreed that infection and constitution were factors, but enlarged greatly the importance of food. To him most disturbances, including even the diarrheas, were due not to infections, but practically entirely to food alone. Clinical pictures to be brought about by improper feeding were four:

The picture of milk injury he saw just as did Czerny, but for reasons which we stated he changed the name to "disturbed balance." His tremendous contribution in this realm was including diarrheal disease in this group. To him the majority of diarrheas do not belong to the infectious group of Czerny; do not belong either to (*a*) those caused by specific bacterial infection of the intestine or to (*b*) those resulting from milk spoiled by bacterial growth, but do belong to the group of disturbances arising from the feeding of good, wholesome, pure milk made into improper mixtures.

The history of the observation and development of the food basis for diarrhea is fascinating. The first stimulus came to Finkelstein and his assistants with the appearance, in their great institution, of a number of cases of severe diarrhea—gastro-enteritis, as they might then have been called, or dis-

turbances of nutrition on the basis of infection, as Czerny would have said. Perhaps, in a way, it was Czerny's conception of food disturbance that led them to investigate carefully conditions in the diet kitchen. To their interest and amazement they discovered that by an error, many mixtures contained unusually high quantities of sugar. Could the sugar be a causative factor?

Full of curiosity, they fed babies large quantities of sugar, produced severe diarrheal disease, and gave to the pediatrics world one of our most wonderful contributions. Not only could high fat and low sugar produce a condition of disturbed balance, but high sugar, on the other hand, could produce severest diarrheal disease. For the moment we see Finkelstein following the same error of Czerny, focusing too carefully upon the stool, upon one symptom, forgetting the big clinical picture and laying blame for almost every case of bad diarrhea on too much carbohydrate in the food. Not long, however, before he saw his error.

The same objection applied to this view as did to the original idea of Czerny. Breast milk, the ideal food, contains a large quantity of carbohydrate,—easily fermentable carbohydrate,—but children when fed breast milk do not develop these deadly diseases. There must be some other factor—some other influence. This is simple reasoning, simple common sense. Careful clinical study again guides us along the right path.

At this time Ludwig F. Meyer, Finkelstein's first assistant, made an important contribution. While his experiments are open to great criticism; while in the light of our present knowledge they can be attacked from all sides, nevertheless, in their day they served their purpose. He took cow's milk and breast milk, separated them each into curd and whey, as, for example (Fig. 12),

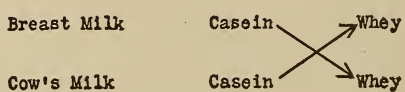


Fig. 12.

and after having divided these mixtures, he crisscrossed, adding the casein of cow's milk to the whey of breast milk, and the

casein of breast milk to the whey of cow's milk. Offering these mixtures to children sick with diarrheal disease resulted in sharp differences. Those getting the mixture containing the whey of breast milk made good recoveries; those getting the mixture with the whey of cow's milk did not do so well.

Gentlemen, although this experiment is open to great criticism, it served its purpose. It called to our attention, for the very first time, the whey of cow's milk. Now we hear of the whey as a factor in producing disturbance. We have heard of protein, fat, carbohydrate, and now we hear *whey;* and, after all, is it not strange that for so many years we have neglected this portion of the milk? Is it not likely that whey, with almost four times the salt content of breast milk, also could exert harmful influences upon the intestine, perhaps due to osmotic conditions or to who knows what? To Ludwig F. Meyer, then, are we indebted for this new inspiration.

While these observations were going on, clinical study again was bringing Finkelstein toward the ultimate truth. Increasing carbohydrate in some milk mixtures resulted in diarrhea. Increasing carbohydrate in others, to his mystification, had no such effect. What could be the explanation? The solution was discovered in combining the above two clinical experiments. When carbohydrate is added to mixtures of cow's milk *rich* in whey, diarrhea results; when carbohydrate is added to mixtures *poor* in whey, no diarrhea results. The more concentrated the whey, the worse the diarrhea! Thus, you see, adding carbohydrate to buttermilk or to skimmed milk will make a laxative combination—these mixtures containing all the whey elements of the milk. Adding carbohydrate to pure whey would cause an intense diarrhea. I should advise you not to try this. What factor in the whey causes these symptoms I do not know. Perhaps it is the salt. As I have said so frequently, "This is clinical observation."

It is human, however, to wish things clear; to have a picture to hold before us, a guide for our thoughts. I can offer the explanation that has been given by our teachers. Do not take it as an absolute truth, but simply as an illustration of the processes of modern reasoning. How can a mixture of whey and carbohydrate produce these results?

Normally, billions and billions of bacteria live in the large intestine. The small intestine is relatively sterile. Only at times when food is digested are bacteria found in any amount in the upper tract. With the disappearance of food, with its absorption through the intestinal wall, the bacteria rapidly go back to their home, to their normal environs in the large intestine. Those left in the upper tract are killed, probably by the intestinal cells and by the digestive juices.

Postmortem examination in many cases of severe diarrhea, however, reveals the *upper* intestine swarming with microorganisms—not abnormal ones, but simply those which normally live in the lower bowel. Gentlemen, what has happened? *Normally* the upper intestine is able to keep its contents sterile. Something must have impaired this function. Is it not possible that the digestive juices and the activities of the epithelial cells have been handicapped by the high salt content, perhaps by the changed salt relations of the cow's-milk whey? Moro's experiments would tend to confirm this hypothesis. In carefully conducted researches he and his assistants showed that the intestinal cells are more efficient when active in a medium of breast-milk whey than of cow's-milk whey.

Once injured, these intestinal cells cannot suppress bacterial growth. Bacteria will thrive and prosper, and *now*, when carbohydrate is introduced, before the intestinal digestive enzymes can alter it, prepare it for assimilation, and carry it through the intestinal wall, the hungering bacteria have seized it, fermented it, and changed it to the irritating lower fatty acids, such as acetic, butyric, and formic. Gentlemen, do you remember that in the first lecture and in the second, also, we tried to impress upon you that when bacteria attack carbohydrate the process is known as fermentation and acid results? Now you understand why. The injured intestinal epithelium can no longer exercise control and fermentation proceeds rapidly. A tremendous quantity of irritating products results, and causes a severe, acid, watery diarrhea. Such is what we reasonably may believe. Clinical observation has painted a picture in abnormal physiology.

To return to the bedside. Diarrheas are of two types:

(*a*) A mild attack, with symptoms described as mild gastro-enteritis or mild summer complaint.

(*b*) An intense attack, often deadly in nature, described as severe gastro-enteritis, severe ileocolitis, or cholera infantum.

The first of these conditions Finkelstein called dyspepsia; the second, intoxication, not because he had isolated any toxin, but because from a *clinical* point of view the little patient appeared poisoned. This, you remember, is a clinical classification. The picture is constantly before us. Explanations will be varied, causes amplified, new factors discovered; but the clinical picture remains unchanged.

## DYSPEPSIA

This is one of the most frequent ailments you meet. The mother brings the babe mainly for relief of intestinal symptoms. The child has mild diarrhea—five, six, or eight watery, green, sour-smelling stools with mucus; vomits occasionally and has colic.

Careful history shows nothing of importance other than perhaps a slight cold. Baby's sleep is disturbed, and for a few days he has not been gaining.

Fig. 13.

Examination (Fig. 13) shows that he is not very sick—he is slightly undernourished, pale, and restless, perhaps peevish and irritable. Consciousness is not affected. There may be shadows

under the eyes and the abdomen distended. Temperature, pulse, and respiration, other than possibly a slight fever, reveal no important change.

Gentlemen, we have spoken about the reactions to food and to hunger. Addition of food or increase of diet to this patient will have little effect. His diarrhea may become *worse*, his general symptoms a little increased, but he will show no radical change. Withdrawal of food—*absolute hunger*—causes a marked *improvement*. Diarrhea ceases and he becomes better, brighter, and happier. There may be a moderate loss of a few ounces of weight for a day or so, but then the curve rapidly swings to normal.

If we study such a child from a standpoint of metabolism; if we analyze carefully the amount of food taken in twenty-four hours and the end-products excreted in the urine and the stool for twenty-four hours, we find the following changes:

*a*. Protein excretion is slightly increased.

*b*. Fat is not changed unless the child has been receiving some quantity in his bottle. Then considerable is found in the stool.

*c*. Starch may be found in the stool, particularly if baby has been receiving a starchy diet.

*d*. There may be a *slight* loss of mineral matter, chiefly of sodium and potassium.

*e*. Most striking is the increased excretion of the irritating volatile lower fatty acids, such as acetic, butyric, and formic.

What is the source of these acids? Czerny would have said that they come from bacterial infection of the milk outside of the body; Finkelstein, that these acids are produced by the normal bacteria of the intestine attacking the carbohydrates of the milk under the accelerating influence of the whey. The splendid studies of the younger men, such as Barth, Edelstein, and others, stimulated by these controversies, have shown that acid formation in the stool is infinitely greater than acid formation in spoiled milk. Thus they must be created in the body.

Just as clinical study enlarged Czerny's idea of fat injury, so did it enlarge Finkelstein's idea of whey-sugar injury. New points added as etiological factors are:

I. **From the Standpoint of Food.**

A. As regards **good, wholesome, pure milk,** the factor which Finkelstein so emphasized:

(1) Simple overfeeding is a frequent cause.

(2) Particularly is overfeeding with sugar-whey mixtures a factor. This was Finkelstein's first great contribution.

(3) In a medium of cow's-milk whey, high sugar plus fat causes these diarrheas. Many men lay primary emphasis upon the latter, for the stools show great quantities of undigested fat. We do not wish to be dogmatic. Undoubtedly high fat, particularly if not properly digested, can produce irritating products and diarrhea. We believe, however, the more important process is the primary fermentation of the carbohydrate, which whisks out the fat in the resulting diarrhea, the fat appearing as a neutral secondary element. We believe that probably the fat suffers secondarily as the acids from sugar fermentation interfere with the digestive enzymes. These, you know, work best in an alkaline medium.

B. **As Regards Spoiled Food.**—From the viewpoint of Czerny, spoiled milk undoubtedly at times provides irritants to the intestine sufficient to cause these symptoms —particularly in older children, during the summer months, are spoiled foods of all sorts important agents.

II. We have relearned the value of *constitution.* The weaker the baby, the more is he predisposed.

III. Frequently repeated mild infections, as coughs and colds, are of extreme importance.

IV. Heat and improper nursing must meet with our consideration, and, of course, time will add new influences to the list. Probably all of these in some way or another will increase fermentation in the intestines.

From this viewpoint you see how *relatively* unimportant is examination of the stool—I mean, relatively unimportant as a strict indication for therapy. In any of these dyspeptic stools, had the baby been fed starch, the starch-granules would have been whisked through by the increased peristalsis; had he

received high fat, the fat would have appeared in large quantities. Had we focused our attention exclusively upon the stool, forgetting the more general considerations, we would have said, "This is a disturbance due to starch; this is a disturbance due to fat"; but now, as Ludwig F. Meyer in his pointed way once said to me, "When you find high fat in the stool, seek the carbohydrate."

**Treatment.**—The treatment based upon these opinions must be self-evident and simple. If the whey is a factor injuring the intestine and permitting bacteria to flourish in the upper tract, it must be diluted. If carbohydrate ferments, we must give it in a non-fermentable form. The more we dilute the whey, the more we reduce the factor injuring the intestine, the safer is it to give carbohydrate. Non-fermentable carbohydrates, we told you, are composed of mixtures of dextrin and maltose and can be offered as Mead's Dextri-maltose. More fermentable are Mellin's Food, Horlick's Malt Food (not Malted Milk), etc. Remember, these substances are carbohydrates, and under no circumstances baby foods. Dextri-maltose, copied from Soxhlet's Nahrzucker, contains most dextrin, and is therefore the least fermentable. Borcherdt also puts up a similar preparation.

Our treatment then for these milder conditions would be:

1. Hunger for twelve to twenty-four hours, not forgetting, however, to keep up a sufficient supply of water. During this hunger period the baby's vomiting and diarrhea empty his digestive tract of all irritants. It is not necessary to give calomel and castor oil, unless, perhaps, foreign substances have been eaten; for the baby, as a rule, can well take care of himself. If you suspect that the trouble is due not to milk, but to corn or cucumbers or watermelon, a dose of castor oil and a mild colonic flushing may do no harm, if given *once.*

2. After this hunger period we start food. To dilute the whey, we give one part milk, two parts water. To this mixture we add 1 or 2 percent of non-fermentable carbohydrate. We boil these together and in six feedings give a total of six to ten ounces in twenty-four hours, always keeping up the supply of water. We gradually increase about three ounces to the total every day or two until we have reached the maximum, depending upon the

baby's age. Then gradually we increase the carbohydrate to 5 percent. In all this treatment our guide must be not so much the stool as the baby's *weight curve* (Fig. 14).

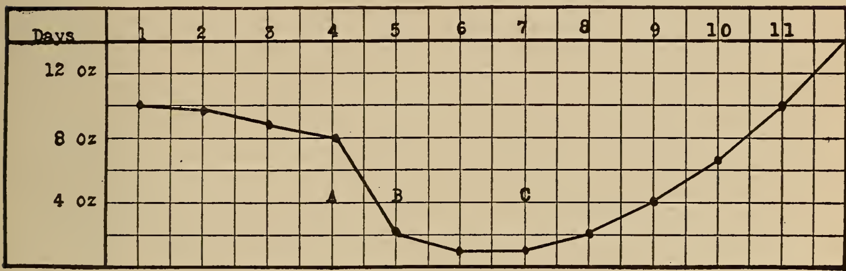


Fig. 14.

At A we have withdrawn food; a loss of perhaps seven to eight ounces results during the next few days.

At B, after twelve to twenty-four hours' hunger, we give a day's total of six to ten ounces. We make no change until at C the curve has straightened, and then we cautiously increase. Remember, the *curve* is the index of the general nutrition, and although this dyspepsia is almost exclusively a local intestinal affair, still the loss of weight resulting from improper treatment proves that the general nutrition also can and does suffer, and if we keep this broad picture before us we shall less likely err badly.

In some cases physicians, instead of giving water during the first day, give cereal waters—barley gruel, etc. This often is fully as efficient as plain water. The dangers, however, are two:

*a.* The physician, in his carelessness, the mother not knowing that barley water is a starvation diet, forgets to add food, and allows the baby to remain on barley water for days. After a period of four, five, or six days the child rapidly develops the condition of Czerny's starch injury, or, as we shall call it, "decomposition."

*b.* Sometimes, after the baby has been on barley water, for

reasons which are not clear, upon the addition of milk to the diet, fermentation again becomes active in the intestine and diarrhea returns.

For dyspepsias in older children the same principles hold good. We shall refer to them later.

Gentlemen, suppose we are ignorant of the food factor in this dyspepsia; suppose we have attributed the condition to something else; suppose we have quieted the child with opiate and allayed the mother's fears; suppose we have thoroughly cleaned out the child with calomel and castor oil; and then suppose, in our folly, thinking the baby must have food, we offer the child one of those mixtures high in the whey elements of the milk and rich in fermentable carbohydrate, such as buttermilk with sugar or skimmed milk with sugar—can you grasp the result?

Shortly we are called to see a desperately sick baby. The child is feverish and lies in semi-stupor. The sunken cheeks, the sharp nose, the ashen, mud-colored, wrinkled skin, the cold extremities, all show great loss of weight and great prostration. Intense watery diarrhea drains the body of its food, pulls out the very building-blocks of the tissues. The pulse is rapid and weak. Lying apathetically, our little patient takes not a particle of interest in his surroundings. The unclosed lids show the glassy eyes fixed unintelligently upon one corner of the room. Occasionally he wakes for a moment, looks at us, cries fretfully, and again wanders off into apathy. The breathing is characteristic, deep, tireless, rapid, unceasing, like the air-hunger of diabetic coma. Occasionally one of the almost limp extremities moves slightly. Sometimes it takes a cataleptic attitude. The arms, particularly, are apt to assume the position typical of a prize-fighter. The urine may show sugar, albumin, and casts.

Examination reveals an enlarged liver.

What have *we done? We* have produced a wonderful, a terrible, clinical picture. We have produced the "alimentary intoxication" of Finkelstein.

Gentlemen, we spoke about the importance of food reactions. Listen carefully: If in this stage we offer our patient a full bottle; if we offer him any large quantity of food, his weight curve sinks precipitately, vertically, downward to rapid death. We have killed him. No surer way have we of doing this than

by offering food; no surer way have we of saving him than by removing food (Fig. 15).

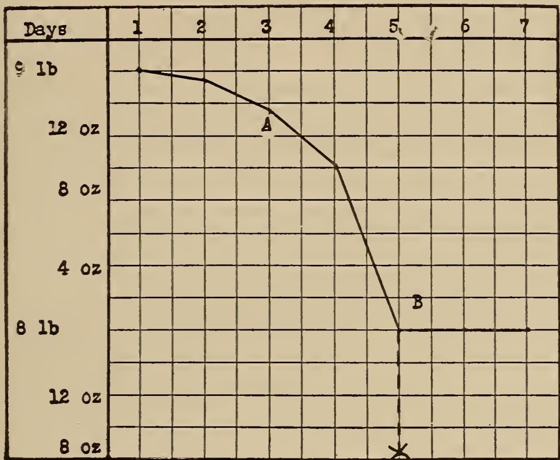


Fig. 15.

In the period of his dyspepsia, if at point A we have mistreated our patient, so that steady progression has thrown him into the stage of intoxication, at B addition of food brings the fatal drop; withdrawal of food straightens out the curve and the child is saved. What more beautiful illustration has one of the effects of food than this clinical observation—than this so-called "paradoxical reaction of Finkelstein"? The food which would cause a normal baby to gain, causes destruction; the hunger which causes a normal baby to lose, is salvation.

What processes are involved in this radical change, in the progress of the mild dyspepsia to the deadly intoxication? Listen carefully: This progress is one of transition from a mild, local, intestinal disturbance to the severest "disturbance of nutrition." In the dyspepsia, constitutional symptoms are mild. The acids formed slightly irritate the mucous membrane and cause diarrhea, but nutrition is not badly affected, as shown by the relatively slight loss of weight. Now note the progress.

Increasing acid formation injures the intestinal wall. The acids become sufficient to interfere with the digestive enzymes. Fat no longer is properly digested, and its split products aid in increasing the damage. In this acid medium new types of bacteria flourish—bacteria which can attack the fat, producing intense irritants.

Before these combined assaults the intestinal wall begins to fail. The membrane remains no longer impermeable to attack. Its weakened strength cannot be detected by the microscope: it can be by physiological experiment. Now for the first time *undigested* food-substances pass the membrane into the body. We have not seen these substances enter, but our examinations have found them as they *leave*. We feed children in this condition lactose, and lactose appears in the urine. We feed foreign protein, and foreign protein reappears. Gentlemen, the process of digestion is to prepare food-stuffs for the use of the tissues. Undigested food circulating in the body fluids is *poison*. See the possibilities of this conception. The mild dyspepsia has progressed so that now the entire body has become severely and dangerously involved.

We can paint any picture. We see undigested protein and poisonous products of the fat taken into the circulation. We see the tissues bathed in strong solutions of sugar and of salt. We see innumerable products of bacterial activity rapidly entering the system. We see chaos where we should see order.

Small wonder at the multitude of clinical symptoms. Convulsions, strabismus, and cerebral cry may suggest meningitis. Gastro-intestinal effects may be great enough to resemble cholera. But in all cases remember that certain symptoms will be constant: the rapid loss of weight, the acidosis breathing, the disturbed consciousness.

The examination of the intake and the total excretion of these children, in contrast to the mild dyspepsia, shows considerable loss of body substance. Protein, fat, and minerals are thrown out by the rapid intestinal movements. The urine shows the most profound changes of metabolism. There is a tremendous loss of water, due, perhaps, not so much to the increased bowel movements, for this loss is compensated by the decreased urine, but to the tireless, rapid, deep respiration. In this condition,

then, we are dealing with an infinitely more important problem than local intestinal disease. As tonsillitis results in endocarditis; as the insignificant wound ends in deadly tetanus, so may the simple dyspepsia lead to a profound "disturbance of nutrition"—"alimentary intoxication."

**Diagnosis.**—The history, in a way, makes the diagnosis. Improper feeding, followed by a disturbance, such as we have described, almost invariably is "alimentary intoxication." However, we have learned from more recent studies not to focus our history too carefully upon feeding alone, but to recognize new factors, which, by their effect upon the baby's general condition, also predispose. To these we referred in dyspepsia, viz., age, constitution, infections, poor nursing, and heat. We have learned that this condition never develops primarily in a well child. There must have been a preceding state of dyspepsia or decomposition. The latter we consider in the next lecture.

The diagnosis is definitely established upon withdrawal of food (Fig. 16).

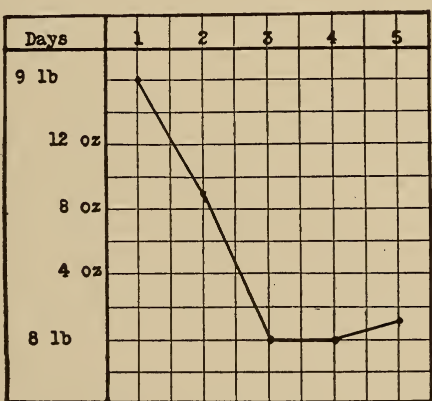


Fig. 16.

If, after twenty-four hours of hunger, the loss of weight ceases, the temperature drops to normal, the diarrhea improves,—the latter, however, not being absolutely essential,—we make a positive diagnosis of alimentary intoxication.

**Treatment.**—1. Gentlemen, during the first twenty-four hours the child *must hunger.* During this day the diarrhea and the vomiting will empty the intestinal tract of irritants.

2. Under no circumstances shall we give calomel, castor oil, or any other irritating drug. Just think! The intestines are acting as rapidly as possible to rid themselves of irritants. They are moving just as quickly as they can; you can't make them move any more quickly; all that you are doing with these drugs is to increase injury. What the intestine needs is not stimulation: it needs a *rest.* For this same reason we would not injure the stomach and intestines by getting a big pump and repeatedly washing out the stomach and flushing out the bowels. *Let them alone!* They will take care of themselves if you give them only half a chance. If your aim in using these drugs is intestinal asepsis, your hope is in vain! No drug is known which will make the intestine sterile. Indeed, animals raised with sterile intestinal tracts live only a short time. Barrels of medicine haven't nearly the effect of a slight change in diet.

In addition to the great principle of physiologic rest during these twenty-four hours we can aid our little patient in other ways:

3. He is suffering greatly from loss of water: we must supply fluids. Give him all the water he wants.

4. The use of a little salt will aid him in *retaining* water in his body. Simply take a little surgical salt solution—physiological salt solution, made by adding a teaspoon of salt to a pint of water; dilute this to half-strength, sweeten it with a little saccharine, and offer the baby three to four ounces by mouth during the first twenty-four hours. Don't give over this amount, or you will produce edema and throw too great a strain upon the heart. Edema readily results.

5. Our little child may need to be stimulated. Under these conditions, brandy in doses of 10 to 15 drops every few hours; caffein citrate, in doses of $\frac{1}{4}$ grain, may be given by mouth. Infinitely more effective is the hypodermic use of 10 to 15 minims of a 10 percent solution of camphor in oil, repeated, when necessary, every few hours. Personally I have come to place more and more confidence in adrenalin. One hears very little of this in medical discussions; but, from my own observations,

I am absolutely convinced that in the failing pulse and sinking blood-pressure of this condition, just as in surgical shock, hypodermic injections of two to three minims, repeated every two or three hours, are of great value. In my own studies I have found that the blood-pressure is raised and maintained for periods of one-half hour following injection, probably by the gradual absorption resulting from subcutaneous rather than intravenous use.

6. During this first day, treatment of the mother is an important consideration. She, in her maternal anxiety, demands that we *do something.* The substitution of tea for water is a great help. From our standpoint, children take it well, like it, and we supply fluid to the tissues. We can explain to the mother, however, that in tea we have caffein, which is a great stimulant; tannic acid, which will tend to combat the diarrhea, and we can make the matter more impressive by adding a little saccharine tablet for sweetening. We can busy the mother, during the first day, with the general care of the baby, keeping him warm, offering with a medicine-dropper small doses of salt solution and perhaps a little medicine at regular intervals, but *under no circumstances* shall we diverge radically from our principles.

7. What medication shall we use for the intestine? Gentlemen, if you have understood the principles of this disturbance, you see that a little alkali can be reasonable and logical. Chalk mixture, with its calcium, can be given in doses of several teaspoons every few hours. It is interesting to see how the older men empirically arrived at this remedy; but, gentlemen, under no circumstances place your faith in medicine; medicines are simply insignificant aids in our treatment, compared to the enormous influence exerted by food.

8. While in the stage of simple dyspepsia, ordinary dilution of the milk and reduction of carbohydrate suffice for a cure, in intoxication we are reduced to the use of two foods only. These are breast milk or, if this is not obtainable, "Eiweiss Milch," or albumin milk of Finkelstein and Meyer.

The principles of this food depend upon ordinary common sense. If carbohydrate ferments, it must be reduced. If whey so injures the intestine as to enhance fermentation, the whey

must be diluted. If casein, by calling forth alkaline intestinal juice, by aiding putrefaction, by combining with calcium, overcomes fermentation and makes the intestine alkaline, protein must be increased. With this object in view Finkelstein and Meyer set about making the albumin milk. It was originally made as follows:

(*a*) To one quart of raw milk add enough ferment to cause coagulation and formation of large casein curds. Any milk-coagulating ferment will do. In Chicago we use chymogen in amounts of one dram to a quart of milk, put up by Armour & Co.

(*b*) In order to separate the curd from the whey we filter, letting the mixture hang in a cloth bag for an hour. During this process all the whey drips off and the pure casein curd remains.

(*c*) This is put through a fine hair sieve, the wire meshes of which must be finer than a window-screen. You understand if the casein is fed in large pieces it will not exert its physiological effects, for only a small amount of it will be exposed to the intestinal juices and to the bacteria and less calcium can be efficient. The center of the curd will be untouched. The success of the mixture, then, depends upon a very fine division of the casein. It must be put through the sieve two or three times.

(*d*) To the finely divided curd we add one pint of buttermilk. Buttermilk supplies salts, and a baby must have salts to live. You ask why a pint of whole milk or skimmed milk will not suffice. Whole milk, you remember, contains fat, which we are glad to reduce in these severe cases. Whole milk and skimmed milk both contain lactose, which is very fermentable. Buttermilk not only has no fat, but also has very little lactose, and possibly even the lactic acid may be of aid.

(*e*) Enough water is added to make one quart. The mixture is boiled, stirred with a *cutting* motion to prevent the reformation of large curds, and divided into bottles. Upon offering them to the baby, these bottles must not be heated above body temperature or large curds again will form. You see now what this mixture contains:

(*a*) The casein of one quart of milk plus that of one pint of buttermilk.

(*b*) The whey of one *pint* of buttermilk; thus the whey has been reduced to one-half.

(*c*) Almost no lactose.

Everything in this mixture speaks for alkali formation—speaks against acid formation. What a curious world! In the olden times we threw away the curd and used the whey; now we throw away the whey and use the curd. This mixture is ideal to overcome the fermentative stool, to neutralize the intestinal reaction, and to stop the diarrhea. Shall we feed this mixture to the baby? What an *ideal* mixture this is to *kill our little patient!* You look surprised. You have made just the same mistake as Finkelstein and his assistants. Reports of protest came rapidly from all over the world. Not long, however, before the error was detected. Finkelstein and Meyer had made the same mistake that we have seen repeated time and time again. They focused too carefully upon the stool and *forgot the baby!* True enough, the intestinal condition was cured; the stools became alkaline and constipated, but the *baby died!* Gentlemen, the baby died from lack of carbohydrate! In our intense desire to treat the diarrhea we forgot *the baby.* The child *must have carbohydrate to live,* and this baby was getting an amount insufficient for life. Without going too much into detail, it was learned that in albumin milk it is perfectly safe to give *at least* 3 percent carbohydrate. If this is given in the form of non-fermentable carbohydrate, such as dextrin-maltose preparations, no harm will result; so in making albumin milk, never commit the fatal error of omitting 3 percent carbohydrate. In offering albumin milk, instruct the mother to use a nipple with a large hole, as some of the casein curds may stick in a small one. You may also add a little saccharine for sweetening, for when the child gets stronger, he may object to the taste of the buttermilk.

In offering the baby breast milk or albumin milk, shall we give a full bottle? Gentlemen, to do so means *death.* Even if a wet-nurse be obtainable, if we, thinking that breast milk is an ideal food, recklessly allow the child to nurse, we probably shall lose him in a few hours. With such an intense degree of fermentation existing in the intestine, the large amount of sugar in

breast milk, even though it be in the healing breast-milk whey, may ferment and increase the damage.

In all cases our technic must be extremely rigid and exact.

1. Keeping up the same general treatment of the first day, stimulation and fluids in the form of tea, we offer ten feedings of about ½ ounce each of food.

2. The next day we increase to ten feedings of ⅔ ounce.

3. The following day we may increase to ten feedings of 1 ounce, then to 1⅓ or 1½ ounces. Here we wait and note the reaction of our weight curve (Fig. 17):

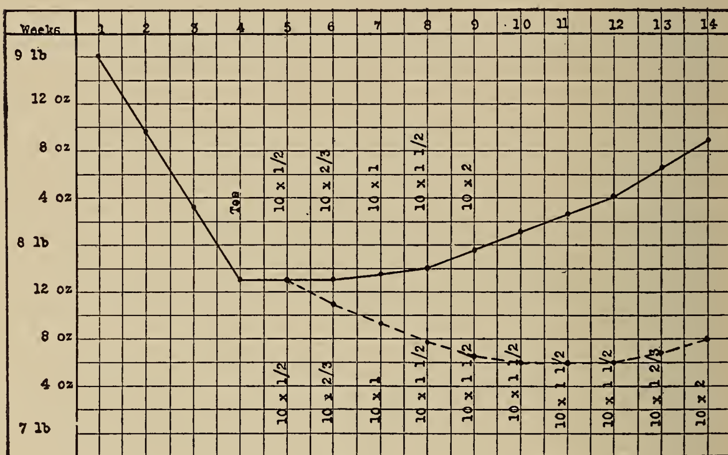


Fig. 17.

We hold the food perfectly constant at 10 x 1½, *independent* of the stools, until the weight curve has straightened out. If the weight curve still sinks; if the diarrhea continues, under *no circumstances* make any change in the food. The danger of a change is greater than the danger of leaving it as it is. When, however, the weight curve has become horizontal, we continue to increase gradually to the maximum quantity; that is, about three ounces of the mixture for every pound of the baby's weight. Then we cautiously increase the carbohydrate to 5 percent. After a few weeks we return to an ordinary milk mixture. It

is *not good policy* at any time to make any change while the baby is gaining.

I have gone into such detail, gentlemen, not because I want you to remember the technic exactly of making albumin milk, but because I want you to remember the principles. If you have these principles, then, no matter where you are or what means are at your disposal, simply make up a combination of high protein, low whey, and non-fermentable carbohydrate. Never commence with large doses, but, following a hunger period, guided by your weight curve, offer gradually increasing amounts.

These principles you can apply to your older children—children of one to three years of age:

1. Hunger with tea and fluids for the first day.
2. Reduce the whey by removing milk or diluting it to one-third or one-half.
3. Increase the protein by giving egg, scraped meat, cottage cheese, and curds of milk.
4. Give non-fermentable carbohydrates, zwieback, mashed potato and cereals, such as corn-starch, Cream of Wheat, and arrowroot.
5. Supply salts best as vegetable purées.

Don't forget the hunger period; don't forget fluids, and, above all things, in the beginning of the treatment, don't forget the *tiny* doses of food.

Gentlemen, if you are thoroughly conversant with these *principles*, no matter where you are, no matter how primitive the home, you will always be completely master of the situation.

## LECTURE VI

# DECOMPOSITION

Gentlemen, in the previous lectures we discussed three types of nutritional disturbance. You remember it was Finkelstein who, for the first time, clearly and emphatically laid importance upon factors of nutrition and food, in the production of what we previously had called "the diarrheal diseases of infants." That many of his first explanations were incomplete; that many of his views again will be amplified, there can be no doubt. But his service has been immeasurable. In the lectures on disturbed balance, dyspepsia, and intoxication we described the clinical pictures as he saw them. Today we concern ourselves with the last of the four, the subject of decomposition. You gentlemen have known this condition as atrophy, marasmus, or malnutrition. It is familiar to you all. Finkelstein, however, did not think that these terms described accurately the complicated processes being evolved in the child's body, and so suggested a term of his own. Names, of course, are immaterial. If you prefer the older terms, well and good. The essential, however, is that you understand the changes taking place in the child. There is an *actual disintegration* of body substance. Finkelstein thought the usual terms misleading and so spoke of decomposition, which in German means destruction.

It is hardly necessary to describe the picture. Doubtless you have seen it often. A tiny, undernourished infant, weight far below normal, lies restless and crying in his bed or in his mother's arms. Simultaneously one notices the pallid, blue, wrinkled, tissue-paper-like, fat-free skin, and the whole bony skeleton that seems to protrude through it. The face is that of a tired old man. The large, deep-seated eyes move restlessly about, then fix upon you with an uncanny stare. The large mouth, with its thin lips opened wide in a never-ceasing fretful cry, is in striking disproportion to the small, weazened face, or is hidden com-

pletely by the fists which the child chews greedily in a vain attempt to relieve his pitiful hunger. The peevish tones reveal perpetual misery. The emaciated skin of the thorax reveals the bony framework in all its detail, and the thin covering of the abdomen cannot conceal the outlines and movements of the

Fig. 18.

Fig. 19

viscera. On the extremities the skin hangs in large folds right over the bones (Figs. 18 and 19).

In sharp contrast to intoxication, consciousness is undisturbed. If anything, it is excited. You remember how the child with intoxication lies drowsily, eyes fixed apathetically on

one corner of the room, arouses himself with a short cry, and again lapses into semi-consciousness. *This* child is on the alert, cries pitifully, incessantly, and never seems to sleep. You remember the child with the intoxication had rapid, tireless respiration. *This* child has the slow, feeble, irregular type. In intoxication the pulse is rapid. In decomposition the pulse is slow and weak. Normally in an infant the pulse ranges around 120. Here it may be 80 or below. In intoxication the temperature usually is elevated. In decomposition it is subnormal—the more subnormal, the worse the disturbance. In contrast to the albuminuria, glycosuria, and casts of intoxication, the urine of this child is negative. Intoxication suggests acute poisoning; decomposition, chronic collapse.

Symptoms from the gastro-intestinal tract vary with the food. Vomiting is not unusual. Stools, however, depend to a large extent upon the diet. When this is large, particularly if high in carbohydrate, intestinal fermentation becomes active, with resulting diarrhea. This is very easy to understand when we consider that the intestinal tract suffers in its general nutrition as much as does every other organ of the body. It is perfectly rational, then, to assume that the functionally injured intestinal cells of the upper digestive tract do not suppress bacterial growth as they do in the normal infant. Consequently any improper combination of food, especially mixtures *rich in whey and carbohydrate*, stir these bacteria to growth, and in the resulting fermentation are formed the irritating acid products which lead to dyspepsia and intoxication. In such a condition, if much fat is fed, it will be carried out in the stool. We do not mean to be too dogmatic. It is perfectly reasonable and logical, and there is also good evidence to show that the digestive ferments are not very active, and we can readily understand the appearance of fat in the stools, due to its improper digestion and assimilation. We believe, however, that in the majority of cases fat appears passively, being secondary to the primary fermentation of the carbohydrate.

On the other hand, if the restricted diet is *high in protein, low in carbohydrate and whey*, the stool becomes alkaline and hard. Now less undigested fat appears. This observation again supports the premise that fat is really the secondary factor.

Again, the smaller the diet, the less likely will the stool be diarrheal. Perhaps no better illustration can be afforded of the danger of being *guided* in treatment by the *condition* of the stools. Many of these babies go down and die in collapse, with typical constipation. No greater or more terrible mistake can be made than of focusing all one's attention upon the character of the stool (treating the stool so as to change it from a diarrheal to a constipated type) and forgetting the baby in the meantime: allowing *the baby* to go down and *die* in the collapse of hunger. This danger can be avoided if one remembers what we have repeated again and again, that the stools are simply indications of what has been put into the intestinal tract, of the way that food has been handled, and are only a tiny guide to us—simply a symptom of scarcely more importance as an absolute indication for therapy than is the condition of the skin, than the condition of the baby's heart and pulse, than the condition of the baby's breathing. They constitute simply one of the many important *symptoms* of the condition. As the weakened pulse points to the failing circulation, so do the abnormal stools point to an inefficient digestive tract. This *latter*—not the stool—is one of the objects of our therapy.

In these conditions we have dwelt upon the fundamental importance of the weight curve and the food reactions (Fig. 20).

If at A, the child being in a state of decomposition, and having lost weight for months, we give a bottle adapted to a normal child, he *loses steadily* three to five ounces a day, and *dies* not infrequently with symptoms of intoxication. On the other hand, withdrawal of food for *twenty-four hours* produces a sharp drop in weight, the child dying in acute collapse.

Gentlemen, no more terrible mistakes are made than allowing children in this condition to *hunger*. They are so susceptible to *all influences* that a period of hunger of twenty-four hours, which scarcely would be noticed by a *normal* baby other than by his loud protests, results in rapid death.

In addition to the above clinical symptoms the child shows great change in reactions to external influences. He is particularly susceptible to heat and to cold. He is susceptible to all forms of violence, readily injured by improper nursing and care, particularly likely to be attacked and carried away by the infec-

tious diseases. Ludwig F. Meyer says aptly that these children sicken from causes of nutrition and die from infection. Fatal infections frequently are overlooked, even by the most experienced, because the child is so weakened in his reactions that the most virulent infections may give no clinical signs. The baby is too weak to react with temperature, too weak to show acceleration of the pulse or of the breathing, and only postmortem examination reveals how frequently our little patients have been carried away with terminal pneumonias.

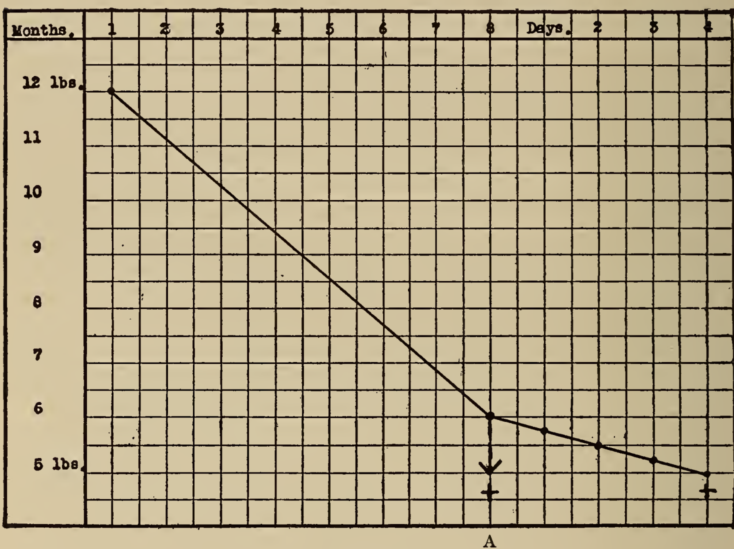


Fig. 20.

Often we find masked types of decomposition. Upon hasty clinical examination, we may think our little patient is only in a state of dyspepsia or disturbed balance. We become suspicious, however, on learning of a previously irregular weight curve, and noting deficiency of fat in the subcutaneous tissues and skin of muddy color. Our opinion will be confirmed when, upon treating this child for a dyspepsia, withdrawal of food produces not the usual slight reaction of the weight curve, but a

sharp, severe drop of many ounces, associated with *subnormal temperature* (Fig. 21).

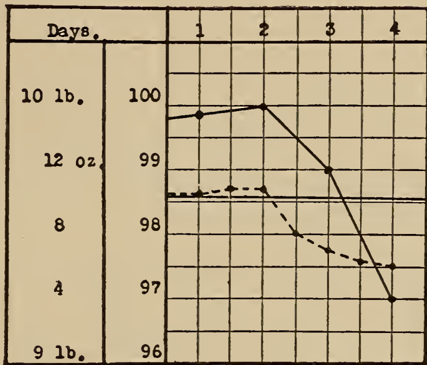


Fig. 21.

Gentlemen, whenever you find a child upon withdrawal of food reacting with symptoms of collapse and subnormal temperature, no matter how slight you considered the disturbance, beware of one of these masked types of decomposition. Remember that *that* child is particularly susceptible to external influences—to hunger, to heat, to cold, to infections, to poor nursing, to improper food—and look upon him as a very sick baby.

**Metabolism.**—Having studied the clinical picture carefully, we now must investigate the causes. Don't misunderstand me, gentlemen; it has long been known that this picture can be produced by tuberculosis, syphilis, wasting diseases, and other conditions; but it remained for Finkelstein to show that a great, great number of these cases—cases in which the etiology previously had been mysterious or unknown—was based upon and resulted from the same fundamental errors in nutrition of which we have spoken so frequently. For the first time we see in careful clinical examination, this condition also studied from the broad viewpoint of nutritional disease. Such a child, when placed upon a metabolism bed, shows a sharp contrast to dyspepsia or disturbed balance, for he suffers actual loss of protein from the body, the body *losing* more *protein* than is taken in.

The same holds true for *mineral* matter; more salts are lost than are contained in the food. Indeed, much of the clinical picture may be simulated by mineral hunger. Such investigations are very difficult, are few in number, but are of tremendous value. It was due to this conception, to this idea, that actual *destruction* was taking place that Finkelstein changed the term from atrophy to decomposition.

The *fat* metabolism depends upon the way fat is administered. If it is given in a mixture rich in carbohydrate and whey, the fat is lost in the resulting diarrhea. If a reasonable quantity is given in a mixture high in protein, low in carbohydrate and whey, the fat is well assimilated.

As regards carbohydrates, the body itself seems to need and use them well. The great difficulty, however, is to get them *into* the body, for with the weakened condition of the upper intestine permitting bacteria to flourish, carbohydrates, unless given very carefully, are apt to ferment and cause diarrhea, with pictures varying from the slightest dyspepsia to the severest intoxication.

**Diagnosis.**—The diagnosis is easy. A freshman medical student, a novice, a beginner, can recognize such a picture at a glance. It makes absolutely no difference what name we give, the clinical picture is there; and it remains for us as medical men not to be content with a mere diagnosis, but to insist upon a diagnosis of the cause. We have spoken of tuberculosis, syphilis, and wasting disease; these are well known; but of new factors from the viewpoint of nutrition we are learning more and more.

1. We have learned that this condition never comes in the midst of health. The child must have been sick for weeks or months, with a history of ailing, of digestive disturbance, and of not thriving.

2. We have learned the importance of age. The younger the child, the more susceptible he is.

3. We have learned the importance of diarrheas, not only those from improper feeding, the dyspepsias, but also those resulting from true pathogenic bacterial infection. In each of these attacks the child probably loses a little mineral matter, and if the diarrhea is not handled properly, the loss eventually may be so great as to bring on decomposition.

4. We have learned that long-continued undernourishment is an important factor, the baby not getting for a sufficient time a great enough total quantity of food.

5. Hunger is a *tremendous* factor, particularly hunger applied *too long* to a *sick* child (Fig..22).

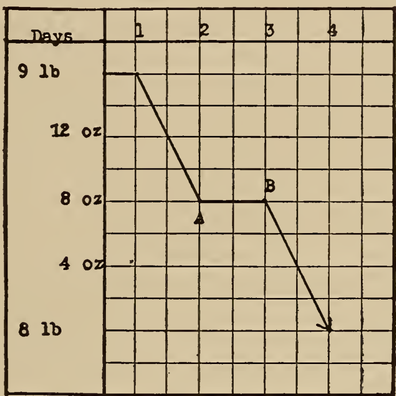


Fig. 22.

You remember in intoxication when the weight curve was dropping rapidly, if we removed food at A for twenty-four hours the drop of weight ceased and the curve straightened out. If at the end of twenty-four hours, at B we had not started to feed that baby *perfectly independent* of the number or condition or appearance of the stools, if instead of feeding him we had prolonged the hunger period, guided *only* by the condition of the stools, the weight curve would have swung down, taken another sharp drop, and *we* would have been responsible for the additional calamity of decomposition.

6. Important as is absolute hunger, partial hunger is perhaps even a more frequent cause. By partial hunger I mean one-sided feeding, such as feeding with barley water or condensed milk. Due to the fault of the physician or the carelessness of the mother, children are kept for days on a diet of barley water. This, as you know, is largely carbohydrate, and after four, five, or six days, the child suffering in the meantime from insufficiency

of protein, salts, and fat, decomposition develops. This type was the one that Czerny described as starch injury. Condensed milk perhaps is the most frequent cause. It is very high in sugar, low in other elements, as protein and salts. You remember in our second lecture we spoke about the property of sugar to bind water in the tissues. Due to the high sugar of condensed milk, a great deal of water is retained in the tissues of these children. They gain for some weeks, and the doctor and mother are delighted, because they think the baby is doing so well. As a matter of fact, however, the baby is *starving*, his tissues are being filled with water, and his body-cells are *dying* from lack of protein and salt. Only the severe reaction following a slight infection, following a little exposure to heat or a slight error in diet (such as feeding a little too much or letting him hunger too long), shows that we are handling a child who really is in the stage of decomposition. Too long exclusive feeding with breast milk belongs to this class. This sounds like heresy, gentlemen; but nevertheless it is true. This is no infrequent factor. As you remember, breast milk is very low in protein and very low in mineral matter. After a child is nine months or more of age the demands of his body are greater than those answered by the breast. Kept too long exclusively upon this food, without the addition of other substances to cover these wants, or without an enormous supply of breast milk, the body-cells suffer from lack of protein and salts, and the child gradually develops decomposition.

7. The most frequent factor of all is probably the fault of the physician, the one for which *you* largely are to blame,—I don't mean *you* personally; I mean you, me, all physicians,—namely, the improper treatment of mild dyspepsias. The development is as follows: The child gets a slight dyspepsia; the physician, not recognizing the food nature of the disturbance, cleans him out with calomel and castor oil; gives him a little paregoric to check the bowels, and makes no change in the food. Repetition occurs in perhaps two or three weeks. Again the child is cleaned out, again is he subjected to the irritating effect of calomel, and again the bowels are drugged with paregoric; but the food is unchanged. Maybe the factor of hunger is introduced. A recurrence of diarrhea leads to the same treatment. Now the

physician says: "We certainly will give these bowels a rest. We are going to let this baby hunger a good long time." No factor, gentlemen, is more important in bringing these children to this condition than is the frequent combination of improper therapy of dyspepsia plus the improper use of hunger. Remember, gentlemen, the longer the hunger, the greater the danger. Remember, the more frequently repeated the hunger, the greater the danger; and remember, the closer together the hunger periods, the greater the danger. This combination of improper treatment of dyspepsia plus the improper use of hunger periods is the most important of all the nutritional factors in producing decomposition.

Besides the above errors in *nutritional* technic, we must never forget that the same influences are effective that were concerned in the production of dyspepsia and intoxication, influences which are independent of our skill, and for which we are not to blame; namely, constitution, infection, and improper care. A baby with a weak constitution, a baby who repeatedly has had infections, a baby who is improperly cared for, is *far* more susceptible to a nutritional error than is a healthy strong child.

**Treatment.**—Gentlemen, let me urge upon you that the most important treatment by far is prophylaxis. If we handle dyspepsias properly; if we realize the importance of the state of disturbed balance; if we see that the well baby is properly nursed and cared for, properly dressed and properly fed, the number of cases of decomposition arising from nutritional sources will be very few indeed.

Once developed, however, the condition is difficult to treat, and requires careful, definite routine. Only upon two foods can we rely. Just as in intoxication, we have absolute confidence only in breast milk or albumin milk.

During the first day, if a bad diarrhea is present, the child may hunger six, to at the *very most twelve, hours; never under any circumstances longer.* Preferably, he should miss only one or two bottles, and none if the stools are few in number. During this period the general treatment is that of intoxication; that is, the use of stimulants, the use of water and tea, the use of a little salt.

Following the hunger period, or if no diarrhea be present *at*

*once*, we start food. The first day we offer ten feedings, with a total in twenty-four hours of ten ounces. Gradually we increase, adding two to three ounces to the twenty-four-hour total every other day. Our maximum with albumin milk is three ounces for each pound of body weight; that is, a baby weighing seven pounds shall get a total of 21 ounces, a baby of nine pounds a total of 27 ounces. During this increase our guide is solely the weight curve. Gentlemen, let me impress upon you that no graver mistakes can be made than letting the condition of the stools influence your treatment. We are interested in saving the baby. The baby is infinitely more important than his gastro-intestinal canal. If to save the baby it becomes necessary to neglect all symptoms of impaired digestion, we must do so. The gastro-intestinal tract is simply a means of introducing nourishment. We *absolutely must* give food. If we let this one symptom, the stool, sway us from our course, though we correct the condition of the stool, we frequently lose our patient. Our guide to increase shall be the weight curve. To illustrate (Fig. 23):

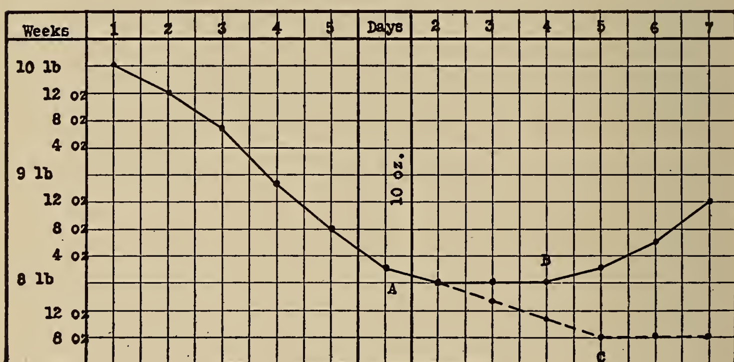


Fig. 23.

The baby has been sick for weeks, the curve constantly coming downward. At A he is in the state of decomposition. We allow him to hunger or offer small quantities of food, a total in twenty-four hours of ten ounces. Due to the hunger or due to the small quantities of food he continues to lose slightly. We

make no change until at B his curve has straightened out. A continuation downward at C shows that the destructive process is continuing; under these circumstances we are in no condition to *increase* the diet, nor to *change* nor to *withdraw* it. If we wish to *save the baby*, we must hold the quantity constant and steady, independent of the stools, until the curve has straightened and shown that destruction is ceasing and that the baby now is in a position to assimilate nourishment. This is the time to start a gradual, cautious increase according to the schedule just given. If the baby is breast fed, under no circumstances put him to the breast the first few days. The mother must express the milk from her breasts and give these quantities *exactly* from a bottle or medicine-dropper. When the curve finally has straightened out,—a matter of a few days,—we sigh with relief, for the battle is won; and *now*, after the child has gained slightly, it is safe to put him again gradually to the breast.

In the last lecture I gave in detail the technic of making albumin milk. I wanted you to know the original process, so as to emphasize the principles of the mixture. You remember they were low whey and low carbohydrate to reduce the factors causing fermentation; high protein to increase the factors causing alkalinity and overcoming fermentation. Today I want to give you a simpler technic quoted by Langstein and Meyer, one which you may use in the humble home, where ignorance of the mother or lack of facilities renders impossible the more complicated mixture.

One takes one quart of buttermilk and one quart of water, mixes them well, lets them boil a few minutes, and allows them to stand for at least half an hour. During this period the casein curd settles to the bottom and the clear whey-water mixture rises to the top. You see, by the addition of water we have diluted the whey one-half. Without disturbing the casein curd lying below, we pour into another jar as much whey as possible. This separates curd from whey. *In this process we boiled the milk. In the original we used it raw. If we had boiled it in the original technic the curds would have been too fine to be separated from the whey, being able to pass during the filtration through the meshes of the muslin bag.* To the casein curd we add four ounces of boiled cream. This is done because in the original

mixture, during precipitation of the casein, considerable fat is ensnared in its meshes, the fat content of albumin milk being 2 to 3 percent. Accordingly, we add cream to this mixture. We then add the usual 3 percent of a dextrin-maltose. Not having "dextri-maltose," we can use foods of somewhat similar nature, such as Mellin's Food or Horlick's Malt Food. Our mixture now contains high protein, a certain amount of fat, a certain amount of carbohydrate in a non-fermentable form, and *to add salts* we fill up to a total of *one quart* with the *original water-whey* mixture in our second jar. You see in this process we have reduced the whey to one-half. In cases where the child does not take albumin milk well it can be sweetened with a little saccharine.

And now, gentlemen, before concluding, let me call your attention to a most fascinating study, one to which this treatment with albumin milk has directed us (Fig. 24).

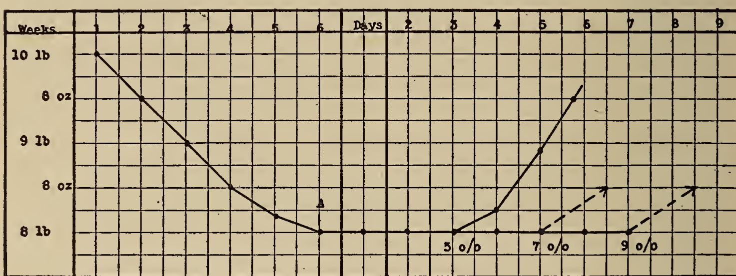


Fig. 24.

At A the weight curve has straightened out, the destructive process has ceased, the battle has been won, and the child is getting the total prescribed amount of albumin milk, but he is not gaining. We are giving the maximum quantity, namely, three ounces for each pound of body weight, but the weight curve is stationary. Here a very interesting study commences. Our first idea that sugar alone is dangerous and harmful makes us very careful about increasing the carbohydrate. We *cautiously* increase to 5 percent. In some cases the weight curve makes a sharp ascent; in others it remains stationary. After

a few days, in the latter case, we feel our way again and increase to 7 percent. *Usually* the curve takes a sharp rise and the improvement continues, but it may remain absolutely horizontal. Again, with *extreme care,* and *under no circumstances* if the curve shows a tendency *to fall,* we increase to 9 percent, and almost invariably with 9 percent the child will gain. With 7 percent or 9 percent the stools may become dyspeptic, but employing albumin milk, we overlook them. *Under no circumstances use such high carbohydrate with any food other than albumin milk.*

Fig. 25.

Here is the baby we just showed as a case of severe decomposition. He entered our hospital wards aged four months and weighing six pounds. On albumin milk with 3 percent dextri-maltose he showed no reaction for three days. An increase to 5 percent resulted in no further gain. Three days later, however, a further increase to 7 percent was followed by a rapid increase in weight and marked improvement in his general condition. This photograph, taken at the age of five months, just four weeks later, shows him weighing nine pounds four ounces. Just compare this to his previous condition, and you will notice the rapid response to high carbohydrate feeding, a gain of 3 pounds 4 ounces in a month (Figs. 18, 19, 25).

This interesting clinical study gives an insight into some of

the processes taking place in the child's body. It shows that this child, to thrive, needs more carbohydrate than does a normal one; and when we stop to think, this is not unreasonable, because he is so handicapped that he probably needs more energy than does the healthy baby to carry him along. Our problem has become clear. We must convey food to this child's *tissues*. In some cases the deficiency is one of protein and mineral matter. In the majority, however, high carbohydrate also must be conveyed. We have before us the problem of sending high carbohydrate into the baby's body; of getting it through the intestinal wall before the hungering bacteria lying in wait in the intestine, can ferment it to the irritating acid products; without its carrying the patient to death from intoxication before it reaches the body-cells craving it. Albumin milk has solved this problem in a mysterious, unexplainable way. It was never devised for this purpose, but it is just as effective, nevertheless. If we feed a child with decomposition a concentrated milk mixture containing high carbohydrate, he rapidly develops the severest intoxication. Whether the child's demands are absolutely specific for carbohydrate or simply for more energy may be open to argument. But even if the latter is true, carbohydrate becomes the most convenient means of supplying the needed energy. With albumin milk we can feed carbohydrate with relatively slight danger of intestinal complication.

How albumin milk does this is unknown. We have much to learn, and perhaps some one will explain it; but it is a fact, nevertheless, that albumin milk has become a vehicle for introducing carbohydrate into the baby's system.

The treatment with albumin milk should last four to six weeks, and then the baby is put upon an ordinary milk mixture. For a few days the stools will be somewhat loose; these can be disregarded. If the baby has been breast fed, although he seems subjectively better, gain in weight may be very slow indeed. This period the older men have called the "reparation period," offering the explanation that during these weeks the child's tissues were reorganized. This failure to gain we now believe due to *tissue hunger*. Breast milk you know is low in salts and in protein. The ideal food for a normal baby, it is not a mixture ideal for an infant to recover severe losses of these

elements. The addition to the breast milk of small quantities of a buttermilk mixture sometimes works wonders. This combination is rich in protein, rich in mineral matter—the very substances in which breast milk is deficient. If given in quantities of one-third to one-half of the total amount of breast milk, the child may gain at a much earlier date and the so-called reparation period be avoided.

Having mastered these processes, we are in a position to treat decomposition in an older child. Always hold before you the picture of the technic with albumin milk. In the older child also, the period of hunger, if diarrhea is present, must be short, and then we start to feed. How shall we make up our diet? First, we reduce the whey as much as possible, the whey being the element that seems to aid fermentation and the formation of irritating acids. This means that we either can remove the milk entirely from the diet or, preferably, dilute it to one-third or one-half strength. To offer the child food which will alkalinize the bowel and overcome fermentative processes we feed high protein, namely, scraped meat, eggs, cottage cheese, or even ordinary curds of milk. Custards are taken well and provide an easy method of offering eggs. To supply carbohydrate in non-fermentable form we use cereals, such as corn-starch, farina, Cream of Wheat, arrowroot, and well-boiled rice. We don't advise oatmeal, because in some cases this seems to ferment easily. Other non-fermenting carbohydrates are mashed Irish potatoes and the doubly baked bread, known usually under the name of "zwieback." Now we have a combination high in protein, low in whey, containing non-fermentable carbohydrates, low only in salts. These we supply in broths and soups and by vegetables ground through a very fine sieve in the form of purées; we supply a mixture high in protein and in salts by offering a small quantity of buttermilk; but remember the buttermilk contains all the whey elements, hence tends to aid fermentation, and therefore should be used in small quantities and handled carefully.

Remember, gentlemen, that the technic we use, however, must be identical to that employed with a little baby. Hunger periods are short; the quantity of food, at first small, is gradually increased, and above everything else the guide to the quan-

tity of food must be the weight curve, rather than the condition of the stools.

The general treatment must be that of intoxication, with particular emphasis upon the protection of the child *from all dangerous external influences*. He must be well cared for, protected from infections, and guarded from extremes of heat and cold.

Our hour is now up. I have tried to impress you with the importance of looking upon these children as children in whom the entire nutrition is changed. In treating such a baby, under no circumstances let the condition of the stool control you. The stools are only symptoms of the condition of the gastro-intestinal tract. The gastro-intestinal tract is simply a means of your introducing proper elements of food into the baby. If you decide that a child needs carbohydrate, then you must give it. Even though the digestive tract rebel; even though diarrheal stools point to fermentation, don't lose your courage provided the weight curve does not begin to sink. In the latter case, under no circumstances totally withdraw the carbohydrate. Humor the digestive tract. Change your food combination. Give your carbohydrate in the combinations in which it will be relatively harmless, such as breast milk or albumin milk, but don't give up your principles. With a little compromise, a little shifting of technic, a wise general can make the digestive tract his obedient servant. Never under any circumstances let it become your master.

*Question* (by Dr. Flippen, Pilot Mountain): Doctor, in the treatment of your older children the diet seems to be much the same, both in intoxication and in decomposition. If the treatment is the same, what can be the difference in the two conditions?

*Answer.*—Intoxication is an acute affair, the symptomatology being induced perhaps by the very rapid loss of water from the body. Intestinal fermentation induced by any cause is the primary factor. Decomposition is a chronic condition, lasting for weeks or even months, the symptomatology being induced by destruction of body tissue from various causes. There is a gradual loss of protein and mineral matter from the tissues, the

intestine suffers secondarily, and thus fermentative processes are easily established.

Our treatment in intoxication is primarily to allow the intestine to rid itself of irritants, and then to give a feeding which will overcome the fermentative processes.

In decomposition we recognize the extreme need of the body for food, but we recognize also the liability of this food to ferment in the intestine; thus, in giving food we must give it just as we would in intoxication, in non-fermentable form. We might say that this form of treatment from an intestinal standpoint is an active treatment in intoxication and a prophylactic one in decomposition.

*This is a good time to pause and to consider for a moment the significance of the entire four groups of cases: disturbed balance, dyspepsia, intoxication, and decomposition. Don't make the mistake of so many and think this was Finkelstein's entire classification. Like Czerny, Finkelstein recognized intestinal disturbances due to many different factors. His great service, however, was to teach us the importance of food, and to demonstrate four clinical pictures with characteristic weight curves, in which food played an important part. In some of these, primary fermentation of sugar featured prominently in the etiology and symptomatology. To speak of the entire group, however, as a fermentative group does not give us a broad enough conception; for in some, putrefaction predominates; in others, intestinal fermentation while causing much of the symptomatology, is secondary to influences besides those of food; and in the largest group, the symptoms are brought about not by fermentation alone, but by fermentation plus a great variety of other factors. These are not exclusively intestinal affairs, but are true* DISTURBANCES OF NUTRITION. *The Middle West has, from the beginning, taken to these ideas readily, and like Finklestein we believe that this conception of* DISTURBANCE OF NUTRITION *is a valuable aid in the therapy of the majority of those cases usually described as the* GASTRO-INTESTINAL DISEASES OF INFANCY.

## LECTURE VII

# PARENTERAL AND ENTERAL INFECTIONS

Gentlemen, we now have finished Finkelstein's original classification. You remember that pathology, bacteriology, and etiology failed us, and for the present we decided clinical observation to be safest. Do not for a moment think that the last word has been said. We are learning every day. New factors are being added, old ideas changed; but if we keep the *clinical* picture constantly before us, we shall not go far astray. To show what the clinical viewpoint has accomplished, let me remind you of the modification of Czerny's idea of "milk injury" effected by clinical studies. Bedside observation and reasoning added the factors of improper care, nursing, post-infection, and insufficient sugar. In the same way I wish to show this morning how careful observation has increased our knowledge of dyspepsia.

The original viewpoint of Finkelstein was that all cases of dyspepsia were due to sugar. Later this was modified to sugar and whey. For a moment he was side-tracked, concentrating too exclusively on the one symptom—the acid watery stool; but clinical observation and thought saved the day. To illustrate:

1. In his institution ten babies lie in each ward. Frequently after thriving for three or four weeks every baby in a certain ward developed diarrhea. Had we focused our attention exclusively upon the stools, we probably would have observed a few curds of fat, a little mucus, an acid reaction, and would have said, "Too much fat" or "Too much sugar" or "Too much something else," and changed the inoffensive baby's diet. As a matter of fact, by keeping the broader picture before us, inquiring into every cause that could be concerned, we learned that the day preceding the disturbance there had been a change of nurses in the ward. This observation was repeated frequently. Almost invariably when a new nurse began her duties

the children temporarily became ill. Why a change of nurses should cause such a reaction I don't know. As I have said so often, "This is clinical observation." Perhaps the secret lies in psychic or nervous influences. At any rate, it was perfectly independent of food.

2. Observations have shown that heat is important. This stimulated the very excellent research of McClure and Sauer at the Children's Memorial Hospital of Chicago.* In very interesting experiments they showed that retained heat is more important than is the general temperature. A baby lightly clothed on a very hot day is less likely to become dyspeptic than is an overclothed baby during milder weather.

3. Keeping the broad clinical conception of "disturbance of nutrition" before their eyes, Finkelstein and his assistants made other important observations. A new baby entered the ward; in a day or two every child would vomit and show watery, green, mucous stools. Clinical pictures varied from dyspepsia to intoxication or decomposition. Had we studied the stools exclusively we would have said, "This child has received too much fat; or this one too much sugar"; but keeping a broader conception before us, trying to consider every factor possible, we learned that the secret of the matter was simply this: the food upon which the baby *previously* had been thriving could scarcely be the primary factor. The new baby, however, had a little *cough* or *cold,* a little nasopharyngitis or grip, and, if she were a little girl, a cystitis. During the following days every child in the ward started to cough and to sneeze, and, *following this infection,* reacted with diarrhea. So frequently was this observed that the men in that institution and in others I visited came to believe that these secondary diarrheas—secondary to little infections—were of as great or even greater importance than the primary food disturbances. To these infections they gave the name "parenteral infections," signifying thereby infections in some part of the body *other* than the intestinal tract. Gentlemen, under no circumstances forget *secondary disturbances due to parenteral infections.* They constitute a large part of the diarrheal cases occurring in your children's practice.

Are you beginning to understand how the clinical classification

* American Journal of Diseases of Children, 1915, ix, 490.

of Finkelstein is helping our study? I do not for a moment consider it finished, but I do consider it a most valuable outline, by which we may direct further observations.

Parenteral infections are so important, I want to talk about them for just a moment. How a cough or a cold causes diarrhea we do not know. Such is purely bedside observation; but human nature seeks explanations, and for that reason I offer the following. Understand, however, it is subject to great modification and change.

As in the primary food disturbance the whey of cow's milk seems to injure the intestine and allow bacteria which are normally present in the large intestine to flourish in the *upper* tract, so in these parenteral infections, as the stools are of the "fermentative" type, we also must have an agency stimulating bacterial growth in the small intestine. How can a parenteral infection increase intestinal fermentation? Two ways become apparent:

1. Finkelstein's assistants have shown that during the progress of these infections, the qualities of the digestive juices are changed. They are decreased in amount and in activity. As a result, two influences may be exerted:

(*a*) Undigested food and sugar will proceed lower than usual down the intestinal tract.

(*b*) The bacteria of the large intestine may come up abnormally high.

2. Products of bacterial action in the nose and throat may impair the function of the intestinal cells and decrease their ability to keep the upper intestine sterile.

In this way, gentlemen, you see conditions in the small intestine are those predisposing to disturbance of nutrition. Here, however, the effect produced is not by the concentrated whey of cow's milk, but by influences perfectly independent of food, namely, the products of the parenteral infection. In either case the presence of hungering bacteria in the small intestine must warn us that feeding fermentable sugar will lead to the production of irritating acids and resulting diarrhea. The disturbance arising from the latter, to distinguish from the *primary* disturbance induced by concentrated whey of cow's milk, we call a *secondary* disturbance of nutrition.

Just as in other conditions, this clinical picture also is influenced greatly by the factors of age (the younger the child, the severer the reaction), constitution, nursing and care, heat, and, above all things, food. Babies fed on mixtures very high in carbohydrate and whey show the severest reactions.

**Diagnosis.**—The diagnosis is relatively easy.

1. History shows the child has had grip or febrile disturbance, followed by diarrhea. The mother calls you for the intestinal condition, completely ignoring the fundamental factor. Diarrhea following a cold practically makes the diagnosis.

2. Food withdrawal for twenty-four hours causes a great improvement in the intestinal condition and any resulting nutritional disturbance, but *does not* influence the temperature. The following day, if the temperature is still elevated, careful examination of the patient shows a pneumonia or an otitis or a cystitis that may not have been evident upon first examination.

**Treatment.**—The treatment divides itself into that of the primary cause and of the secondary nutritional disturbance.

The primary *infection* is, of course, to be treated according to its nature.

The *secondary disturbance* is to be guided purely and simply by the *weight curve.* If the curve rises continuously, as is the case in the healthy breast-fed baby, steady gain being noted each day in spite of abnormal intestinal movements, *let that*

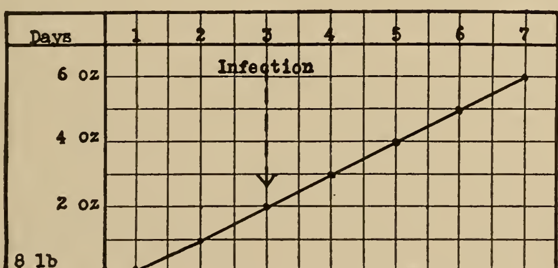


Fig. 26.

*baby alone!* (Fig. 26). Don't, under any circumstances, change the food. See the picture! Under the influence of the parent-

eral infection a little fermentation has been induced in the intestine, but there has been *no nutritional reaction* whatsoever. The effect is purely and simply local and intestinal, and needs no more food treatment than does the irritated nose in a coryza. The weight curve doesn't even show the reaction of a dyspepsia.

Another type of reaction, the type which appears in the somewhat undernourished breast baby or in the fairly well-nourished bottle baby, is illustrated as follows (Fig. 27). At A

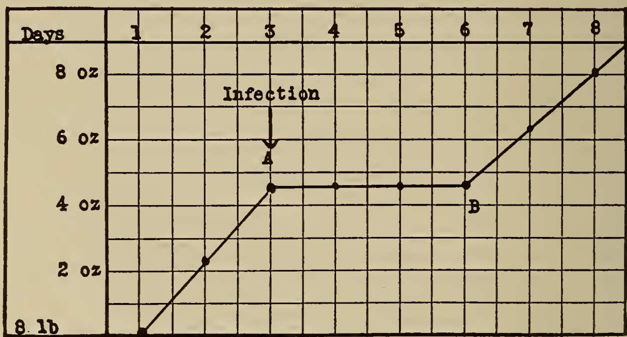


Fig. 27.

the child becomes infected. The accompanying fermentation is severe enough to produce a mild dyspepsia. The change in the weight curve shows that baby's nutrition is beginning to suffer. Shall we change the diet in this case? *Let the baby alone!* Again see the picture! The fault was not primarily with the food. It lay in the infection of the nose, throat, or bladder. A mild secondary disturbance of nutrition has arisen, but if we simply *wait* a few days, the cough and cold will disappear, and after the injuring factor has gone, the intestine corrects itself at B, the weight curve starts to ascend and diarrhea disappears.

*In these two instances treat the mother as you will, but unless he begins to lose weight, don't treat the baby.* Let him take as much food as he will. He drinks less than his normal amount, and so spontaneously prevents the occurence of a secondary disturbance.

Fundamentally different is a third type (Fig. 28), occurring in babies fed on one-sided carbohydrate mixtures. The baby on condensed milk or barley gruel, the baby with a masked type of decomposition, shows a sharp and severe reaction. With the onset of the infection diarrhea commences. The *stools* may not vary markedly from those of the other children. How misled we would be by focusing exclusively upon them! But *the child* reacts with a marked disturbance, varying from a mild dyspepsia to the severest intoxication or decomposition. In these cases *forget* the primary factor. From his cough and cold the mother may think the baby is very sick, but *you* know that death is

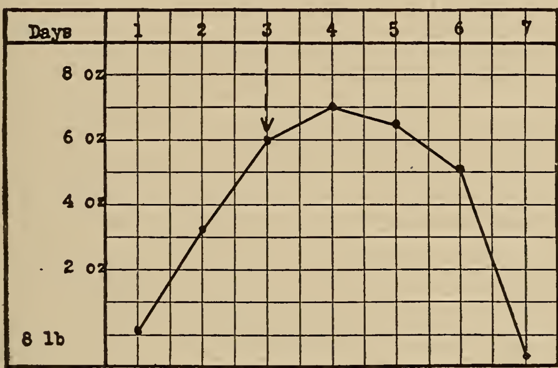


Fig. 28.

going to occur *not* from the infection, but from the severe secondary *disturbance of nutrition.* First and foremost, the *latter* must receive your immediate attention, and you treat it, depending upon its nature, according to the principles laid out in previous lectures.

Two symptoms arising in the course of a parenteral infection may need treatment:

1. *Vomiting.*—If the vomiting be due to a primary food disturbance, the child recovers upon removal of the primary cause, namely, the food. If, however, the condition arises from a parenteral infection, change of food will have no effect, and unless we stop the vomiting we have trouble. In these cases

gentle stomach washing is of value, as are also mildly anesthetic drugs, such as novocain, in doses of $\frac{1}{60}$ grain before each meal.

2. *Anorexia.*—If the loss of appetite is due to food, removal of the cause will cure the condition. If the cause of anorexia, however, is the parenteral infection, change of food will have no influence. In these cases physicians often make fatal errors. One often hears, "If the baby won't eat, we'll starve him to it." No graver error can be made than this. The cause of the baby's loss of appetite is not the food, but is the product of the parenteral infection, and you may starve him and starve him, but his appetite will not return. What you accomplish, however, by introducing the factor of hunger is to throw him into the state

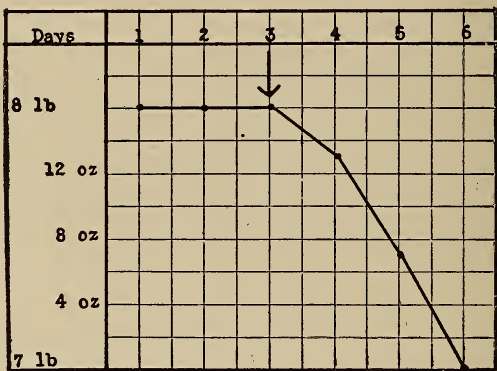


Fig. 29.

of decomposition (Fig. 29). Many of the deaths occurring during mild infections are due not to this cause, but to the factor of decomposition developing from the associated anorexia. Gentlemen, the baby *must have food.* If he takes it in no other way, use a stomach-tube. I don't mean, now, that you must get a pump and pump gallons into his stomach, but you must introduce small quantities, enough to keep him alive, and of such proportions as to avoid the dangers of a secondary dyspepsia or intoxication.

The factors of heat, of food, of parenteral infection, and of care usually are *all* concerned in these dyspepsias and intoxica-

tions. In recognition Finkelstein suggests classifying them etiologically as follows:

I. Purely alimentary or food type.

II. Mixed type (in which all influences are concerned).

## INFECTIOUS DIARRHEAS

Gentlemen, we have now finished the "Disturbances of Nutrition." I want to take you far away for a moment to view an entirely different group of diseases. While the success of high protein, low whey, non-fermentable carbohydrate was attested by the consensus of opinion of the whole world; while in the Finkelstein clinic a great international assemblage of men had collected,—men from America, England, Austria, Russia, Japan, Bulgaria, Rumania, Switzerland, Portugal, and other countries,—all testifying to the great influence of these teachings, a communication came from A. I. Kendall, of the Boston Floating Hospital, saying that the treatment of severe diarrhea was low protein and high carbohydrate. Could anything be more tantalizing, more aggravating? Just at the moment when we thought the problem of diarrhea in children forever solved, when we thought the infallible remedy for all diarrhea was high protein, low whey, non-fermentable carbohydrate, we must read that the proper treatment is low protein, high carbohydrate, and carbohydrate in a fermentable form, such as lactose. The first inclination was to do as always, when some one disagrees with us—to question the writer's sanity. Careful study of the publication, however, showed that Kendall was speaking of a group of diseases entirely different from those we were studying. His work had to do with the *true* infectious diarrheas—those due to specific microörganisms; the type of case we did not see. The communication was so interesting that I resolved, upon my return to this country, to try to meet Kendall. To my great pleasure I learned that he had been called to take charge of the Department of Bacteriology at Northwestern University Medical School, the institution with which I was to be connected. He, with the true interest of the bacteriologist, was concerned mainly with the deadly infectious diarrheas: I chiefly with the question of nutrition. To settle the point as

regards the nature of material in Chicago, we made a study during the summer of 1914.

Dr. Alexander Day, one of Kendall's associates on the Boston Floating Hospital, examined bacteriologically all cases of severe diarrhea in our wards. He cultured carefully all the stools, while I studied the cases from the standpoint of "nutritional disturbance," looking at them clinically and noting their weight and food reactions. Our results showed that, during this summer, in our wards in Chicago, one or two cases of diarrhea showed the gas bacillus in the stools; two cases showed reactions to food typical of the primary food disturbances, and the remainder were those associated with coughs and colds—the so-called parenteral infections. During a study made the following year we found two cases of severe dysentery sent to the hospital from out of town—cases entirely different in nature from our own, and showing symptoms identical in every respect to the dysentery infection which Kendall had noted in Boston. In the stools Dr. Day discovered the true organisms of dysentery.

Why is it that in Boston infectious diarrheas and in Chicago nutritional disturbances prevail? The failure to discover infectious diarrheas in Chicago could not have been due to technic, as the investigations were conducted by the same men. We must regard these results as conclusive. Day and I offered the explanation that, in the sense of Brennemann, the difference may be due to the fact that in the East raw milk had been used, and in Chicago, boiled milk. Isn't it reasonable to assume that in the East, with raw milk, infectious diarrheas prevail; in the middle West, where these organisms have been removed by boiling, nutritional disturbances only are seen?

Gentlemen, in this part of the country probably many of your patients use raw milk. When you are called to see a baby with diarrhea, you are at once confronted with the problem, "Is this an infectious diarrhea or is it one of the nutritional type?" To distinguish between these is of fundamental importance. We have several means.

**History.**—The acute infectious diarrhea starts suddenly in a previously well baby and prostrates him at once. The nutritional disturbance comes more gradually. In the latter we get a history of improper feeding, of previous nutritional dis-

turbance, of parenteral infection. It is more gradually progressive.

**Stools.**—These are of considerable aid in our diagnosis. In the infectious diarrhea, particularly dysentery, they are very frequent, small, and chiefly blood-stained mucus. They contain barely any solid material, and the microscope reveals pus. They may be identical to the evacuations in intussusception. The reaction in dysentery is alkaline. In nutritional disturbance the stools are green, usually acid, and watery. They contain *increased* solid material and some mucus; rarely blood or pus unless the case has long been neglected.

**The reaction to food** is of value. If, after twenty-four hours of tea, the temperature continues high, the weight curve sinks, the diarrhea continues, with small, bloody, mucous stools, then some factor other than food must be at hand. If careful physical examination rules out parenteral infection, such as pneumonia or sepsis, the diagnosis, by exclusion, will be enteral infection.

**Treatment.**—Gentlemen, what I have to tell you about the treatment of true infectious diarrheas will be disappointing. All that I can do is to expose our ignorance. The treatment depends just as absolutely upon definite bacteriologic diagnosis as that of diphtheria depends upon throat culture. How to treat cases of infectious diarrhea in this part of the country I do not know, for I have absolutely no idea what types of infection you meet. If it is a gas bacillus, one food must be given; if it is a dysentery bacillus, radically the opposite treatment must be instituted. Bacteriologic methods of diagnosis are difficult—a trained bacteriologist is necessary. An agglutination reaction in dysentery, such as the Widal in typhoid, can be of service. All that I can do, gentlemen, is to urge you, in connection with your medical society, to coöperate with the State Board of Health or with the State University in attempting to discover what types of infection exist here.

I won't bother you with the technic for isolating the dysentery organisms. The gas bacillus, however, can be detected relatively simply:

To get a sterile specimen of the baby's stool, round the ends of a piece of sterile glass tubing about the thickness of a lead-

pencil, and insert it into the rectum as you would a thermometer. Usually a little fecal material enters. If the rectum is empty, repeat in an hour. Then inoculate a small quantity of the stool, about the size of a pea, into a test-tube of milk. This is heated to 180° F. for half an hour. All bacteria are killed except the spores, which resist heat, and, when the milk is incubated at body temperature, grow rapidly. If they be those of the gas bacillus, they split sugar into acetic and butyric acids, and characteristically give the odor of rancid butter. Secondly, the acid causes the casein to coagulate. This precipitates in large curds, but, due to the growth of the gas bacillus, has the appearance of being completely "shot to pieces." Lastly, the microscope shows the large Gram-positive bacillus.

The treatment for gas bacillus infection, according to Kendall, is based upon the observations that the organism grows well in sugar and does not grow well on high protein or lactic acid. In such an infection, therefore, the treatment is buttermilk. Albumin milk, due to its high protein, low carbohydrate, and lactic acid, would also be ideal. Kendall made the interesting suggestion that perhaps some of the cases that Finkelstein treated so successfully with albumin milk were really those of gas bacillus infection. This is a very interesting suggestion, but I don't believe will prove true as a general rule.

The treatment of true infectious dysentery is based upon entirely different principles. Here great ragged ulcers line the intestine. In these the dysentery organisms live and produce toxins, just as do diphtheria bacilli, from their location in the throat. Death occurs in dysentery largely from toxemia. You see then, gentlemen, how hopeless is drug therapy. We may give calomel. We may give medication to flush out the intestine. With small quantities we may do no harm. To me, however, giving cathartics in such cases suggests reaching in with a forceps and tearing out the membrane of diphtheria. What folly! If our sole therapy in diphtheria is physical injury, we kill the baby. Our treatment lies in antitoxin; and so it is with dysentery. Our ultimate success must lie in the administration of antitoxin if we can give it in time.

In speaking of calomel, gentlemen, I understand that it is used considerably down here and that you place great faith in it.

It may be very efficient. I do not know, because I do not know the existing types of infection. May be you have organisms to which calomel is deadly. That remains to be seen. After all, the wisest is to establish means for obtaining *definite* diagnosis.

The general treatment of dysentery must be that of all infectious disease. Keep up the fluids, provide proper nursing and care, stimulate if necessary. Opium is of great value. In nutritional diarrheas opium, by disguising the symptoms, might lull us into an insecure, dangerous self-satisfaction. In dysentery, however, where the bacillus and not the food is the cause, we disguise no symptoms with opium, but quiet our little patient and relieve the pain and tenesmus. Give as much as you can with safety. As regards medication, quinin tannate, in doses of 3 to 5 grains three times a day, is highly recommended; but, as I have said so frequently, do not put too much confidence in drugs.

The dietetic treatment is radically different from that of nutritional disturbance and from gas-bacillus infection. Theobald Smith, the great American bacteriologist, years ago observed that if the diphtheria bacillus be grown on carbohydrate it will not produce toxin, but if grown on protein, it produces the typical toxin of diphtheria. Kendall, working from this viewpoint, experimented with dysentery and found that if it be grown on carbohydrate, no poison is produced, while if grown on protein, the deadly dysentery toxin results. This explains, then, why in dysentery he advocated high carbohydrate feeding. He wished to get carbohydrate to the organisms growing in the intestine, thus preventing the formation of toxin. Two forms of dietetic treatment may be employed:

1. *Breast Milk.*—Breast milk with low protein and high carbohydrate is a food ideal for Kendall's requirements, and at the same time does not endanger the child from a nutritional standpoint.

2. *The Frank Treatment.*—This is the most successful of artificial feedings. I give it as recommended:

(*a*) Tea for twenty-four hours, except in cases of decomposition.

(*b*) On the second day start with five feedings, each of which is composed of two ounces of whey and two ounces of gruel.

(*c*) Gradually increase by the fourth or fifth day to five feedings of 2½ ounces each.

(*d*) On the fifth to the eighth day, in teaspoonful doses, slowly replace the whey by milk. See the importance of diagnosis! We have ordered a mixture of sugar, salts, and barely any protein for five days. This would have been the worst possible in nutritional disturbance or gas-bacillus infection.

(*e*) On the twelfth to fourteenth day, perfectly independent of the stools, the patient must be getting 13 to 14 ounces of gruel, 13 to 14 ounces of milk, and 6 to 7 ounces of broth. He also may receive a little cereal, as rice, farina, Cream of Wheat, etc., and, if over one year of age, a little meat.

This is the most successful up-to-date treatment for infection with true dysentery. How complicated, how long, often how unavailing! Why not with one stroke save your patients and yourselves all this wearisome treatment and danger, practise a little prophylaxis, and *boil* the milk?

We have now finished the subject of nutritional diseases. We have given you some of the viewpoints developed in the great European clinics and adopted in the middle West. You may have wondered at the hours given to nutritional conditions, and have been disappointed in the few words given to infection. Time prevents a thorough consideration of everything. I laid most emphasis upon the former, with the idea of preparing you for the future. I believe that if you boil your milk, disturbance of nutrition will be the type preëminent, the picture which will become more and more apparent in your practice.

I have spoken chiefly of our ideas in Chicago. Other viewpoints you may obtain from the many excellent American textbooks on the subject. We prefer the clinical classification because we believe the broad conceptions in it will aid us in further study. We like the term "disturbance of nutrition," rather than that of gastro-intestinal disease, because we believe this conception prevents our focusing too closely upon the stool. Even though the primary causative factor lay in the intestinal canal, we believe the baby's general condition far more important than his gastro-intestinal tract. Our whole plan of feeding and therapy depends not upon the stool, but upon the *weight curve*. We believe the *latter*, if controlled by *conscientious*

*history* and *physical examination*, gives the best index of the baby's general condition, of the combined influences exerted by "*food*," by "*intestine*," and by "*demands of the body*."

Just one word more. A recent communication of 1916 from Dr. Louis W. Hill, of Boston, who is conducting so successfully the sections in the East, divides diarrheas into three groups, namely:

1. The infectious type.
2. The nervous type.
3. The fermentative type.

Regarding the latter, he goes into some length, showing the antagonistic effects of protein and carbohydrate, laying emphasis upon carbohydrate fermentation in the production of the irritating lower fatty acids, and recognizing carbohydrate as a primary factor even in some cases where much fat is excreted.

There must then be very little difference between the opinions of the East and middle West. Why have we disputed? Powers of observation do not depend upon geographical location. There must be some deeper factor, some truer explanation. One thought constantly repeats itself in my mind: Cannot the whole difference be explained upon the basis of boiled milk? Isn't it possible that conditions in the East are undergoing evolution; that during the period of raw milk, pictures of the spectacular, deadly infectious diarrheas exclusively prevailed? But now, as I understand it, boiled milk is coming into its own. Isn't it possible that for the first time, the gradual waning of infectious diarrhea reveals the rise of disturbances of nutrition? We eagerly shall await new developments.

LECTURE VIII

## ARTIFICIAL FEEDING OF THE NORMAL INFANT

Gentlemen, artificial feeding in the middle West has developed from the studies we have described. We never start with a preconceived idea as regards a definite and exact formula, but by knowledge of the various disturbances arising from improper combinations we select mixtures to avoid them. The fundamental requisite in infant feeding is a little good common sense.

Before going into detail, it might be well to rid ourselves of a few conceits. A young animal, even if starved, nevertheless continues to grow. He will not gain in weight, but he will in size. So it is with the baby. Don't for a moment think that *you* are responsible for the baby's growing. You simply offer him bricks and mortar for his tissues, but you certainly are not responsible entirely for his growth. Don't take yourselves too seriously. You are an outside factor, an external influence—important, it is true, but by no means the sole cause of baby's thriving.

Remember that the mother does not feed the baby at the breast. The baby feeds himself. The mother does not start with the preconceived idea of how much, of how many ounces, she is going to give the baby. She simply puts him to the breast, he takes what he wants, and when satisfied, stops.

Gentlemen, get the idea out of your head that you are going to *feed* the baby. Leave a litttle of the responsibility to him!

Remember, by all means, that the baby is *human*. Think of yourselves, for instance; your appetite varies depending upon the weather, upon your mood, upon the nature of the food. On a hot day you eat less; on a cold day, more. Amounts vary daily. Some of you are vegetarians; some of you meat eaters; some of you not particular. So it is with the baby. Remember that he is human, that his appetite will vary, that no two babies

are alike; meet him half-way, and rather than expect all concessions from him, make a reasonable attempt to adjust your mixtures to his demands.

Remember that when *we* eat our fundamental worry is "will this food agree with us?" If we take our meal without digestive trouble; if we get the food past the intestinal tract into the body, our troubles largely are over. The body uses what it needs and throws out the excess. Why should the baby be different? Any food which easily and harmlessly passes the intestinal tract into the body, and at the same time contains enough bricks and stones and mortar for the body tissues, will provide for the baby's growth. He retains what he needs and casts out any excess, whether it be breast milk or cow's milk.

Thus, you see, many systems of feeding may be successful. There is no one system which is exclusively right—many methods are right. Our main concern is *simplicity*. We must answer the body requirements and employ the intestine simply as an agent for introducing food-stuffs.

How often shall we offer food? Opinion varies from two to four hours. Czerny advises adhering rigidly to the four-hour schedule—five feedings in twenty-four hours: at 6, 10, 2, 6, and 10 o'clock, and from 10 at night to 6 in the morning the baby to receive nothing. He insists upon this schedule for all babies, and undoubtedly this method is attended with much success. The claims in favor of it are: first, it is scientific (based upon physiological reasoning), and second, it is a great help and convenience to the mother. From my own experience, I find many children do well on four-hour nursings, but it seems to me also that many of those under two to three months do not seem satisfied when made to wait so long and do better on a three-hour schedule. And so, as a matter of routine, I order for all children under two to three months seven feedings—at 6, 9, 12, 3, 6, and 9 o'clock and once during the night. Undoubtedly, however, many of these would do just as well on the Czerny system, and when they do, it is a great convenience to the mother.

Recently the very interesting experimental work of Professor A. J. Carlson, of the University of Chicago,—who has done so much to clear up the physiology of hunger,—goes to show that

perhaps, after all, the three-hour system is based upon more scientific principles than the four-hour one.

The number of feedings varies somewhat with locality. I believe in the East they feed more frequently than we do. A simple experiment which we made in the Finkelstein Clinic might explain these differences. Babies in some wards we fed according to the percentage method; babies in others we fed according to the methods I am about to teach you. All were given five feedings in twenty-four hours. The percentage babies vomited more than did the others. As the percentage method frequently requires more fat than does ours, we reasoned that this vomiting might possibly be due to the fat, *i. e.*, to the irritating lower fatty acids contained in cow's milk fat. Empirically we controlled this vomiting by feeding smaller quantities more frequently; so in a short time all the percentage babies received several more feedings a day than did the others, and all thrived beautifully. This may help explain the difference in the various feeding schedules.

*What* shall we offer? Almost any system of feeding has its ardent advocates. The possibilities of the normal child's intestinal tract are immense. The normal baby thrives upon a great number of mixtures. Therefore it's easy to understand how many different systems have arisen, each with its enthusiastic adherents. The French, for instance, have at times recommended full boiled milk. Many children do well on this; some don't. Biedert, one of the older German pediatricians (he it was who first described casein curds in the baby's stool), recommended the dilution of whole milk to lower the protein. To make up for the loss in strength he added cream and sugar. The resulting combination resembled somewhat a percentage mixture. Some children thrived beautifully; some did not.

Heubner brought calories to our notice. He first advocated feeding 45 calories per pound body weight for children under six months. This system is not ideal, as you readily see. A child's bottle may contain the proper number of calories, but they may be only in fat or in sugar, and will not satisfy the demands of his body tissues. Again, newer studies show that mysterious invisible substances, called vitamins, play important rôles in growth. The excellent work of the men at the Uni-

versity of Wisconsin already has subdivided this new group into fat-soluble substances found in butter, and water-soluble substances found in wheat embryo, both of which are absolutely essential to an animal's growth. These, of course, cannot be measured by caloric value. We of the Middle West do not follow rigidly, but we value the caloric system chiefly as a check upon us, and when a baby is not gaining, we occasionally run over the formula and estimate approximately how many calories it represents. But let me emphasize that we do not advocate this as a *method* of feeding. It is simply a check upon the fuel value of food that we are offering.

An ingenious advance was the percentage system, used by our friends in the East. It was first devised for the purpose of making the relations of protein, fat, and carbohydrate in cow's milk similar to those in breast milk, but, as I understand it, now is offered simply "as a method of calculation and a means of attaining relative accuracy in the preparation of infant's foods." For such a purpose we welcome it heartily. We of the Middle West do not use it, not because we object to accuracy, but because we find the percentage formulæ somewhat cumbersome and because we accomplish excellent results with methods which to us seem simpler.

Ludwig F. Meyer once said to me: "What an ideal combination would result if one would take your percentage method of feeding, striving as it does for accuracy, and adapt it to the principles we are attempting to develop!" Gentlemen, I think this would be a step in the right direction. In this entire course I have attempted to teach you not rules, but principles. You know that in infants fed with boiled milk we consider most disturbances due to fermentation of carbohydrate, induced either primarily by improper relation to the whey, or to the fat and whey; or secondarily to one of many parenteral factors. In all cases, however, we pay far more attention to the baby as a whole than to his intestinal tract. Gentlemen, don't forget these principles. With them you may face any nutritional disturbance with equanimity. Make up your mixtures as you will. By all means strive for accuracy. If you find the percentage method of calculation of value as a check, use it. From our system of feeding, however, has developed, I believe, the simplest

technic for answering the above requirements. But any simpler method of calculation which will enable us, while still being true to our principles, to make up mixtures with even greater accuracy, we shall always be glad to adopt.

## METHODS OF THE MIDDLE WEST

Our system is prophylactic from the start. We have learned that the fault does not lie exclusively with one element of the milk: that it depends upon *improper relations of the different elements*. Thus, if we give much sugar in concentrated whey, diarrhea results; if we give the same sugar in highly diluted whey, the chances of disturbance are decreased. If we give fat in combination with high carbohydrate in a medium of cow's milk, we frequently have trouble. The fat may be involved either primarily or secondarily. If, however, we give this very same fat in combination with albumin milk, viz., with high protein, low whey, and non-fermentable carbohydrate, the fat becomes harmless. Fat in an acid intestine enhances diarrhea; in an alkaline intestine, enhances constipation. Again, we may offer rather concentrated whey, even as full milk, which the French have done, and experience no difficulty whatsoever until carbohydrate is added. In our feeding we attempt to dilute *all* elements of the milk and to make our additions with only one. In the baby's intestine high fat and high sugar in cow's milk are not agreeable companions. Prophylaxis is our motto, and we proceed as follows:

1. To protect our baby from dysentery and other virulent infections, and to prevent the formation of tough casein curds, we *boil the milk*.

2. To prevent the accusation that we are predisposing to scurvy we add, at the end of the first month, orange-juice in doses of a teaspoonful each day. Dr. Alfred Hess, of New York, has shown this to be extremely important.

3. To prevent the danger of overfeeding, we are careful as to the total quantity of food. How *much* do we offer? Naturally, the amount in each bottle must depend upon the fuel value of the food and the number of feedings: the more frequent the feedings, the less the individual quantity. But don't try to

follow any hard and fast outline. Remember, we are treating babies, not manufacturing rules. In a general way the first time we see a child we guide ourselves as follows:

(*a*) By the end of the second week an infant will drink in twenty-four hours a total of roughly 15 ounces, increasing to 20 ounces by the end of the first month.

(*b*) During the second month he increases this total to 25 ounces.

(*c*) During the third month he drinks a quart

This is no rigid routine. Some babies take more; some less. Try the baby on this amount and see how he reacts. The first formula is really a feeding experiment.

4. To protect the child from nutritional disturbances arising from improper relations of the various ingredients, we bear the following picture in mind. I do not believe you will find it formulated just as I give it, but in a way it represents our point of view (Fig. 30).

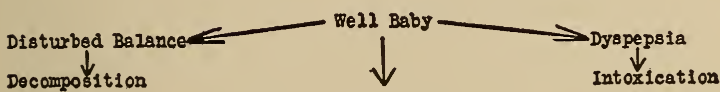


Fig. 30.

This illustration shows the well baby included in the group of sick babies, and suggests that this very same well baby can be made to assume any one of four clinical types. The factors concerned in these changes are the improper usage of carbohydrate and whey and the improper understanding of the rôle of fat as a secondary factor. The conditions on the right develop from too high carbohydrate in concentrated whey; the conditions on the left arise, as Czerny would have said, from too much fat; as Finkelstein would say, from *too little* sugar. Of course, constitution, infection, etc., are important accessory agents.

What is the purpose of this scheme? It suggests that our attitude must be identical to that, for example, in typhoid fever. In typhoid we don't treat the disease: we simply try to guide our patient through the difficulties that lie in his path; and so it is with infant feeding. We don't *feed* the baby: we simply guide

him. In ordinarily diluted milk we try to avoid the dangers of excessive carbohydrate, on the one hand, and of insufficient carbohydrate, on the other.

5. The next step in our scheme of prophylaxis requires a careful history and physical examination of the patient. If he be a weak child; if he have dyspepsia; if he have a parenteral infection; if he be suffering from poor care, we must be careful as to ordering a high percent of carbohydrate—*never* over 3 percent to begin with. If the examination suggest a condition of disturbed balance, or if the child be *recovering* from an infection, he needs *increased* carbohydrate or at any rate *increased energy*. Our problem in the latter case is to offer the increased carbohydrate to the body in such a way as not to endanger the intestine.

How shall we make mixtures to avoid intestinal complication? Gentlemen, this sounds complicated, but it is extremely simple. There is nothing to it. You may banish from your minds any worries regarding the difficulties of infant feeding. It's the simplest branch of pediatrics! Simplicity is our motto, and, indeed, so simple is our method that any novice can use it successfully. To illustrate: In our stomachs a great quantity of hydrochloric acid is secreted daily, but this acid is very dilute. The same total quantity in concentrated form would be deadly. So it is with milk. Train yourselves to think in terms of concentrations—the more dilute the mixture, the less injurious to the intestinal tract and to the *body tissues* after its absorption.

1. For the first four weeks we use one part milk and two parts water—one-third milk.

2. During the second month we use equal parts of milk and water—one-half milk.

3. From the beginning or middle of the third month we use two parts milk and one part water—two-thirds milk.

In these mixtures, as the strength of the milk is weakened, we must offer additional food, and preferably one element rather than two. This is done best by adding carbohydrate in nonfermentable form, such as dextri-maltose, etc. We use approximately 3 percent the first time we see the child, and, depending upon the reaction, increase gradually to 5.

To illustrate: Suppose we saw for the first time a normal baby of one month. We would say: This child shall receive a con-

centration of one-half milk. He drinks roughly 20 ounces a day, so we'll order—

Milk .................................. 10 ounces
Water ................................. 10 "
Add 3 percent of dextri-maltose or, roughly, five teaspoons.
Boil for one minute, and divide into seven bottles of about 2½ ounces each.

If the child were three and one-half months old, we'd say: He can tolerate a concentration of two-thirds milk and drinks a quart a day, so we'll order—

Milk .................................. 20 ounces
Water ................................. 11 "
Add 3 percent of dextri-maltose, or about eight teaspoons.
Boil and divide into five bottles of six ounces each.

Don't take these mixtures as final; simply make up one on such principles and then adapt it to the baby. Some of our Chicago pediatricians make practical application of these principles in a slightly different way. During the first few months they order slightly greater concentrations of milk than the above and avoid disturbance from the concentrated whey by keeping the carbohydrate low, *i. e.*, 1 to 2 percent. The writer prefers the more dilute mixtures with higher carbohydrate, however, for two reasons:

(a) Constipation of an obstinate nature is less likely to result with the higher carbohydrate diet. The concentrated mixtures with low sugar lead to putrefactive processes in the intestines, and, although the babies thrive perfectly, probably using the protein for energy, the mothers are never satisfied.

(b) On the more concentrated mixtures with lower carbohydrate children often drink greater total quantities than those on the less concentrated, higher carbohydrate diets. While in private practice and infant welfare work, where children receive individual attention, they thrive perfectly, in hospital wards these larger quantities frequently induce vomiting.

During these first months, what shall be our guide? How shall we know that the baby is doing well? Gentlemen, under all circumstances let the weight curve, controlled by history and

physical examination, be your index. If the baby is gaining an average of five to seven ounces per week, and at the same time seems *clinically well,* let him alone. No matter though his stools be a little dyspeptic; no matter if he have a slight colic or slight diarrhea: if he is gaining in weight, *let him alone.* Your main difficulty will be in treating the mother, particularly the mother of the first baby. She sits at the bedside; in one hand she clasps "Mother So and So's Guide to Infant Feeding," "based upon forty years' experience." She searches each stool, seizes with enthusiasm upon any slight abnormality, as a tiny curd of fat or a little mucus, and tells you, with gloomy joy, that the food is not agreeing with her baby. Under these circumstances treat her as you will. Tell her that the condition is normal; that Mother So and So's book is old-fashioned. Do anything you wish: but *let the baby alone.*

In a few conditions gain of weight may be deceptive. High sugar mixtures, as condensed milk, and particularly mixtures rich in both sugar and salt, may cause water-logging of the body and not an increase in true tissue substance. Salt in itself may do this in certain types of nephritis. In fever there is often acute retention of water, with a corresponding gain in weight, and again we know that a child may be gaining nicely and at the same time develop rickets. But history and physical examination easily will preclude such errors, and knowing the dangers in advance, you will avoid them.

During the first months you must see the baby or hear from the mother every few weeks, and you will be called to meet several indications.

(*a*) The child may vomit. This we will discuss under Breast Feeding. But remember not to get excited. If the baby is gaining, tell the mother the vomiting is of no significance, is normal, and make no change unless vomiting is very severe, when you might reduce the day's total feeding by a few ounces. If the baby is not gaining, it might be better to make no change in the day's total, and give a greater number of feedings, thus decreasing the amount in each bottle.

(*b*) The child may not gain, and the weight curve become straight or begin to drop. The stools are not more than two or three per day. Under these conditions take the mother into

your confidence—many mothers really have more intelligence than we imagine; ask if the baby seems hungry; does he cry directly after finishing his bottle, put his fingers into his mouth between feedings, fret before the next bottle, seize it with avidity and drain it rapidly? If so, increase the total quantity of food by a few ounces, making no change in the proportions. However, if he seems satisfied with the quantity, one could increase the milk exclusively an ounce or two, or the carbohydrate exclusively by 1 to 2 percent, but not both together.

(*c*) If he is not gaining, does not seem extremely hungry, and is suffering from constipation, then it is perfectly safe to increase the proportion of carbohydrate in the diet to 4 or 5 percent. In this increase we have a true means of winning mother's affection. If our increase is in non-fermentable carbohydrate, gain in weight may result, but the constipation will persist. If we increase with fermentable carbohydrate, such as milk-sugar, or, more simply, cane-sugar, not only will gain in weight result, but the resulting fermentation corrects constipation. So, by striking the proper balance between dextrin-maltose, on the one hand, and fermentable carbohydrate, on the other, we have a means of regulating absolutely the condition of the intestine and of bringing joy to the anxious mother's heart.

(*d*) If the weight curve straightens out, but at the same time the stools are four to five daily and fermentative, we are confronted with the one problem that may arise in this system of feeding. Dyspeptic stools may be a symptom of underfeeding or beginning dyspepsia. History and physical examination aid us greatly. If the child shows definite symptoms of hunger; if questioning shows the mother has not of her own accord made changes in the mixture, and if examination shows that the child *looks well*, then it is safe cautiously to increase slightly the amount of food, noting the reaction. Here one never would increase the proportion of carbohydrate, but simply the *total* quantity, not changing the relations of the different elements. If, on the other hand, the child shows a tendency to avoid food, —these little children often are so much wiser than we,—if examination shows him not looking well, slightly feverish, rings under his eyes, and, above all things, that mysterious change in the skin (the rosy pink becoming an ashen gray), we know we

are dealing with a case of beginning dyspepsia. Now, an increase of food will make the disturbance worse. Give the baby only the quantity he wishes and await results.

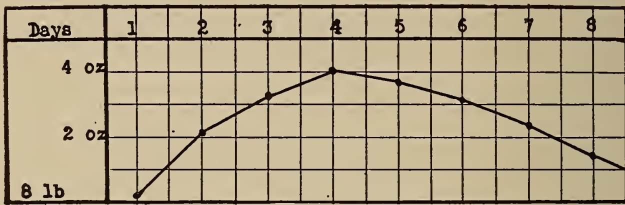


Fig. 31.

(*e*) If, in connection with the fermentative stool and the child's change of appearance, the weight curve definitely starts to drop, then we *are* dealing with dyspepsia, beginning intoxication, or decomposition, and treatment must be instituted accordingly (Fig. 31).

(*f*) If the baby isn't gaining, we rarely increase the day's total much over a quart. Many men give 40 ounces or more. The reason I do not is that on the breast the baby doesn't get much over a quart. A larger quantity throws an excess of water into the system, and why burden the baby's metabolism with taking care of this excess of fluid? We know that from birth on the body becomes relatively poorer and poorer in water. If at the fifth month the baby ceases to gain, offer more food in the form of cereal and a slowly increasing mixed diet. My own impression is that when once on a mixed diet, children are more immune to infections and to nutritional disturbances than those on large quantities of fluid.

In all cases, by watching our weight curve and by studying our little patient carefully, we can check most disturbances before they develop, and the severe conditions will be few indeed.

What is the advantage of our method over the others? Perhaps its extreme simplicity. Any method used by one trained in its application will be successful. Our method, however, we believe easiest for the untrained man—the man who has not had time to work up his own technic.

As an example of this let me quote my experiences in the Chicago Infant Welfare Society. This organization was founded by private subscription some six or seven years ago. Its object was not charity, but education. The idea was to reduce infant mortality, not by medical treatment, but by prophylaxis; not by curing the sick baby, but by keeping the *well baby well.* With this end in view one station was organized in our poorer districts. A physician attended twice a week. A salaried nurse was in charge. Mothers were urged to bring their *well* babies for advice as to feeding, and during the intervals between conferences the nurse went into the home and gave simple instruction as to the technic of making the mixtures. No medicine was given; no milk supplied. The mothers could buy their milk where and from whom they chose. At the station they got nothing but advise.

Gentlemen, the success of this new experiment was astounding. The swarms of mothers flocking to the first station, the immediate lowering of infant mortality, were all the evidence necessary to show the success of this new departure. Under the able leadership of Dr. H. F. Helmholz and Dr. Walter Hoffmann, the organization has grown in the last few years from the original one station to 21. The numbers of infants seen in an afternoon average about 30, but often reach 50. Wherever a station is opened, in that district infant mortality drops. This experience was in a way very humiliating to me. I served the Society for several years as assistant medical director. During that time I had ten or eleven stations under my charge and visited them each once a month. I saw many men for the first time come to take charge; saw these men instructed in the above simple methods of feeding, and saw these men in a very few weeks' time obtain just as successful results as I did with a much wider experience. They had never read Finkelstein or Czerny or Heubner; but the results accomplished were all that were necessary. Nothing speaks more for the simplicity of our feeding than the success of the Infant Welfare Society. True disturbances of nutrition rarely arise. The children become simply "feeders."

In this work, gentlemen, one fact has impressed me most strongly. That is the fundamental, the previously unrecog-

nized, but indispensable, services of our nurses. We, in the stations or in the dispensaries, see the baby for a moment and write out a formula for the milk mixture; the nurse, however, goes into the home and meets the true condition. She sees all the great influences which are at work,—the accessory aiding influences,—the influences which constantly are undermining the baby's constitution and upsetting our plans. She instructs the mother as to proper clothing; she teaches that on a warm summer's day it is unwise to wrap the baby up in thick layers, surround him with a pillow, or place him near the kitchen stove. She informs the mother about the dangers of flies, and attempts in a simple way to protect the child from these pests. She shows how to bathe the baby. She dwells upon the importance of regularity of feeding; she demonstrates the proper care of the bottle and the cleansing of the rubber nipple; she shows how to keep the milk cool if no ice-box is available, by placing the bottle in a tub of cool water; in short, she fulfils the indications which Schlossman so pointedly expressed when he said, "A good nurse can always overcome the mistakes of any poor physician."

Gentlemen, those of you who are interested in infant feeding, those who wish wider experience in dealing with nurslings, those who wish to do inestimable good in the poorer districts, should attempt to establish an Infant Welfare Society; and, in your own practice, profit by the lessons that we have learned. Where these splendid nurses are not available, be yourselves *a little more the nurse, a little less the physician.* Explain clearly to the mother that she is not doing her duty simply by mixing the milk in the proportions you have suggested, but that she must fulfil all the other requirements which are so essential to the baby's general health, and without which *any* system of feeding will fail. If you will only lay sufficient emphasis upon the *nursing care* of your infants, the feeding will almost take care of itself.

Have we spoken the last word? Is our method going to last? I do not think so. New advances constantly will be made—ones we shall adopt, no matter what their source. I believe that we have mastered the art of guiding food past the intestinal tract into the body, but rather than rest upon our laurels we must arise to attack newer and more intricate problems—ones

which loom ominously before us. Are our combinations those best adapted to meet the *demands of the body?* In years to come we may learn that boiled milk has produced some hidden, undiscovered damage. We have learned that high carbohydrate, fed exclusively or in combination with high salts, fills the tissues with water but does not satisfy their hunger. Some evidence shows that children fed with no fat in the diet may at times possess a decreased immunity to infection. We may learn in time that our moderate reduction of fat, our slight increase of carbohydrate, though passing the intestine easily and safely, may not have been a combination best adapted for the body tissues. Only years of study and observation will answer these questions. The physiologist, Friedenthal, recently has devised a mixture in which the salt proportions are identical to those of breast milk. In this mixture fat and carbohydrate may be given in the same relations as in breast milk, with little evidence of intestinal disturbance. This is again a splendid step: a means of introducing fat and carbohydrate into the tissues in the same proportions as they exist in breast milk, and with no danger to the intestinal tract, but is as yet somewhat impracticable.

Until these indications can be met practically and simply; until we can introduce to the tissues food-stuffs in the same proportions as they exist in breast milk without in any way impairing digestive and assimilative functions, we believe that our method of feeding is the most feasible. It is easily employed, seems to satisfy the mothers, seems to provide for the growth of healthy, thriving, happy babies, who *look well* and *strong* and appear *smiling* and *contented*, and, first and foremost, it answers the requirements of *simplicity.*

## LECTURE IX

# BREAST FEEDING

I have neglected the subject of breast feeding until now because often it becomes necessary to supplement the breast with the bottle. If we have mastered the art of prescribing artificial mixtures, then difficulties with supplementary feeding will be very slight indeed.

It is not necessary to emphasize the importance of breast feeding. You know that breast milk is the natural food. You know that the breast-fed infant is more immune to infectious disease than is the artificially fed. You know that mortality is much less among breast fed than among bottle babies. Whenever there is any possibility of offering breast milk, by all means do so.

General contraindications to breast feeding are few. As you know, tuberculosis in the mother almost unanimously is agreed a distinct one, but even against this some voices have been raised. Tubercle bacilli have never definitely been demonstrated in human milk, and some men claim if the mother, during nursing, will protect the baby from her coughing, that tuberculosis is a contraindication only from her own standpoint and not from that of the child. This, however, is the opinion of a few, but I give it to show that even against the most orthodox of all contraindications objections have been filed. I believe, though, that the consensus of opinion makes tuberculosis of the mother a contraindication to nursing, not only from her own standpoint, but also from that of the child.

Severe constitutional diseases, such as malignancy and epilepsy, are, of course, contraindications.

As regards acute infectious disease, such as typhoid, scarlet, diphtheria, etc., opinion, particularly in European clinics, is becoming more and more tolerant. The newborn has consider-

able immunity to infectious disease. Again, very few pathogenic bacteria have been demonstrated in breast milk, and the theoretical objection that toxins are excreted may be met with the theoretical answer that antitoxins also will pass to the child. Even in diphtheria, if the child be properly immunized, breast feeding is permitted.

These opinions of the European men may seem rather radical to you. I give them, however, to emphasize the importance in which breast feeding is held, and to show that most contraindications are those raised in consideration of the mother rather than the infant. Even in erysipelas, where a superficial infection of the breast makes it possible for organisms to pass to the milk, this may be drawn off, boiled, and then offered to the baby.

Syphilis, as you know, is an indication, rather than a contraindication. Whether the syphilitic woman be mother of an apparently well baby, or whether an entirely well woman be mother of a syphilitic baby, in all cases we should insist upon breast feeding, for in both these conditions we believe that mother and child are alike infected.

Some difficulties arise, however, from local changes in the mother's breasts. Perhaps two are important:

1. Retracted nipples make much trouble, cause great anxiety to the mother, and to considerable extent handicap the nursing. In many cases, however, if the mother practises patience, these difficulties can be overcome. Instead of surrendering in despair, simply tell her, "Yes, it's going to be hard for the baby to nurse, but if you practise patience and perseverance, after a week or two he may learn to take the breast." Patience and perseverance are the requisites necessary, and after a week or two of conscientious work the mother may be able to educate her child to nurse from nipples that previously seemed hopeless. Application of a breast-pump between nursing periods aids in drawing them out.

2. Erosions and fissures are extremely disagreeable. By the pain inflicted upon the mother they make nursing a very great burden indeed. The variety of treatments offered is of itself sufficient evidence of the inefficiency of any particular method. Medicaments suggested are:

(*a*) The use of a cotton swab saturated with 1 to 2 percent

silver nitrate solution, and laid upon the fissure for a minute once during the day.

(*b*) The following prescription of the French is one highly recommended by Langstein and Meyer. Personally, I have had no experience with it, but I give it upon their recommendation. The technic is as follows: Wash the nipple after nursing, and apply the following mixture on sterile gauze:

| | |
|---|---|
| Tincture of benzoin | 12.0 |
| Sodium borate | 8.0 |
| Glycerin | 20.0 |
| Rose-water | 40.0 |

Cover with oiled silk or gutta-percha and bandage. Before the next nursing wash off with lukewarm boiled water.

A valuable point in treating these fissures is the use of a mild local anesthetic ointment. A 5 percent salve of anesthesin applied to the fissures just before nursing is a great relief to the mother. Anesthesin is not poisonous to the child, and is very acceptable to the mother on account of the relief from the severe pain. In order to give the painful nipple as much rest as possible, longer feeding intervals should be employed; indeed, one might substitute a bottle for one nursing. Nipple-shields too are of great value. The very best of these is a large one, made of pure rubber, covering almost the entire breast.

Difficulties with nursing from the standpoint of the child are not many. A cleft-palate or harelip is to be considered. These handicaps, like the retracted nipple, often can be overcome by patient, conscientious work of the mother. Many cases which seem hopeless at first, after a week or two of devoted care may learn in some way to obtain milk from the breast.

Other difficulties, such as a neuropathic constitution of the child, we shall consider in the next lecture.

As regards the entrance of milk into the breast, this occurs between the first and eighth days—usually about the fourth. Often, however, it is delayed, and you are asked by all concerned, "Can we hasten it?"

Gentlemen, there is one, and only one, lactagogue you may use with any degree of assurance, and that is the nursing infant. The only stimulus to a breast is one arising from this source.

Wet-nurses in European clinics sometimes nurse four or five babies, and often secrete two to three quarts of milk a day: the greater the stimulus to the breast, the greater the response. And so, gentlemen, to hasten the entrance of milk into the lagging breasts, urge the frequent and regular application of the infant. Of course, if the mother believes that any particular medicine or any particular drink is going to help her, or does help her, by all means don't discourage her. Do anything you can to put her mind at ease, and at the same time to keep her in the best physical condition. If the baby does not nurse very vigorously, you may use a breast-pump also; but this, in connection with massage, electricity, and all other artificial aids, is infinitely less efficient than the normal natural method.

If, in spite of frequent, regularly repeated applications of the babe to the breast, the milk still delays, how long shall we wait? Safely, a few days. During this time we must be very careful not to entirely appease the baby's appetite with artificial food. We must keep him hungry. We want him to tug good and hard at the breast, and therefore, during this time, we offer only a little water or weak tea. By this method we can accelerate the appearance of the milk. However, gentlemen, don't focus your attention so carefully upon the mother that you forget the child. Don't let your zeal for hunger lead you into the greater error of letting the child suffer from *too much* hunger. In all these cases, as I have repeated over and over, our index is the baby's *weight curve*. The physiologic loss of weight during the first few days amounts to from one-half to one pound. If the child shows no tendency to recover, or if he continues to lose, we must heed this danger-signal and direct our attention more to the babe and less to the mother. We must put him to the breast more frequently, using both breasts if necessary, or if this is impossible, add a bottle to the diet. We must never for a moment allow the hunger to develop *weakness*, for if the child becomes too weak to nurse properly, we defeat our own purpose.

Among the laity the general opinion is that breast milk is influenced, as regards quantity and quality, by many different factors—by diet, by medication, by nervous influences. As a matter of fact, accurate, scientific experiments showing changes in breast milk are very few indeed. You must remember that

the amount of the individual ingredients secreted during the *individual* nursing varies. Fat is in small amount at the beginning, and increases toward the end. To get experiments not subject to criticism one must analyze twenty-four-hour specimens of breast milk.

Experiments which will withstand searching criticism are few, but those that have been made suggest that nervous and psychic factors, pregnancy and menstruation, positively have no effect upon the *quality* of the breast milk. Undoubtedly children show disturbance at such times, particularly during the menstrual period, but our present observations tend to show that these disturbances are due to changes in *quantity* rather than *quality* of breast milk. Less milk is secreted, the child is hungry, becomes peevish, irritable, and fretful, and the natural conclusion is that the *quality* of the milk is changed—that the milk is not agreeing with him. As far as we know now, however, there is only one definite change, and this usually a *diminution* of the total secretion.

As regards the influence of diet, we despair more and more. No one in experiments devoid of criticism has shown that he can control at will the quantity or quality of breast milk by change of diet. Many of the statements you read as to the efficiency of diet are based upon only the most superficial investigations. There is one exception, perhaps, this being with fat. In underfed, badly nourished women, high fat feeding at times seems to increase the fat in the milk secreted. There is some doubt, however, as to whether this influence is exerted also in well-nourished women. Probably it will hold absolutely true only in the undernourished.

We are in the same position as regards medication. Every drug in the pharmacopœia at some time or other has been tried. Every one in turn has been given up. The latest is pituitrin. This, in definite physiological experiment, will increase the amount of milk excreted in a given time, but again must we be disappointed. Most recent observations show that it acts upon the smooth muscle-fibers, causes them to contract, thus forcing the milk more rapidly from the breast, but that it in no way affects the *total secretion*.

There are two ways by which we may affect the supply of

breast milk. Undoubtedly one is by building up the general nutrition of the mother—good hygiene, good food, fresh air, and plenty of exercise. Many nursing mothers are lax in this respect. Besides hygiene, there is the aforesaid suggestion, namely, the use of a hungry, healthy, strong child. So much difficulty, however, attends this in private practice that it is really just as satisfactory to add a supplementary bottle after each feeding from the start.

As a matter of fact, in most disturbances upon the breast the following scheme is satisfactory. Make up your mind that breast milk is always *all right* in quality. Make up your mind that the only difficulties arising from breast feeding are those of *quantity*. Treat the mother as you will to put her mind at rest, but from your own standpoint conduct your treatment along the lines of correction of the *amount*, and if you keep your child on four-hour feedings, this correction will be one usually for underfeeding, rather than overfeeding.

You see why in relatively well-nourished babies who are not gaining on the breast I like to wait a week or so without the supplementary bottle. I reason that may be from nervous factors or constitutional change there has been a temporary diminution in the secretion, and that, after a week or two, this will right itself. However, where the condition has lasted longer, out of consideration for the child we are justified in no further delay.

Just a few words about the technic of nursing, because errors in technic sometimes are responsible for many disturbances. Some men would not place the newborn to the breast at all during the first twenty-four hours; others would every six hours. As long as one keeps up the supply of fluid, these differences in technic are of slight importance. Personally, I believe application to the breast is better, as it stimulates secretion of milk and possibly also uterine contractions.

*Question* (by Dr. Summerell of China Grove).—Doctor, have you had enough experience in the country to have seen newborn pigs?

*Answer.*—No; my personal experience in that direction is limited.

*Question.*—Well, the minute pigs are born they make for the

breast and nurse right away. Don't you think it's a good idea in our treatment to follow the lead of nature?

*Answer.*—Yes, that's an interesting point. I think if we physicians had more experience with country life it would be better for us. I should consider that observation as valuable evidence in favor of putting the child to the breast during the first day.

As regards rigid disinfection of the breasts, our ideas are changing more and more. Where the mother practises ordinary cleanliness, application of strong chemicals to the nipple is absolutely uncalled for. Of course, in very poor districts, where the breasts are caked with dirt, they must be washed thoroughly; but in ordinary private practice cleansing with a little cotton and lukewarm water is all that is necessary. If the mother be of the modern, scientific type and wishes something more fashionable and *antiseptic*, use a little boric solution. Personally, however, I believe the use of strong antiseptics a frequent cause of painful, fissured nipples.

*Question by Dr. Summerell.*—In the cases of our poor patients, where the mother's work keeps her all day long in the fields, where underclothing is changed infrequently, and where clothing is, of course, saturated with perspiration, where absolutely no care of the body is taken before the baby nurses—in such cases, doctor, do you advise some sort of application to the nipples?

*Answer.*—Where the breasts and nipples are dirty, of course they should be cleaned, but the best means for this process is ordinary soap and water.

*Question.*—Do you believe the offensive odor of the clothes in such cases would interfere with the baby's appetite or predispose to disturbance?

*Answer.*—The influence of bad odors and bad air upon a nursling's appetite is open to dispute. I believe, however, that most men think this influence unimportant.

How often shall we put the baby to the breast? The same rules apply as to the bottle baby.

How long shall we allow the baby to nurse? Until he is satisfied, and this requires from fifteen to twenty minutes. The first five are the most important, for in these five the baby

gets the greatest amount of milk. You easily can tell, gentlemen, when he is satisfied by the cessation of the swallowing sound. When he is hungry, he nurses and swallows constantly. When he ceases to swallow and lies playing idly with the nipple, he has had enough. If he has emptied the breast thoroughly and still is not satisfied, we either order an increase in the number of feedings or put him to both breasts. But in the latter case we must be perfectly sure that the first breast has been emptied thoroughly. A child is easily spoiled, and if the second breast awaits him, often will not thoroughly empty the first. Of course, the reduction of the stimulus will cause reduction of the amount of milk secreted.

One little point of technic often is overlooked—a point of considerable value, even though used by our grandmothers. You remember our grandmothers used to interrupt the nursing at intervals to place the baby so that the abdomen was against grandmother's shoulder. Then she would pat him on the back until he belched up some air. In the younger days of pediatrics any practice interfering with the quiet of nursing was rejected. Recently, however, we are learning that there is much truth in grandmother's advice. If you hold a baby when nursing in front of the fluoroscope, you will see that he frequently swallows air. A large bubble collects in the upper part of the stomach. This interferes with the proper filling of the stomach, prevents his getting sufficient food, often makes him vomit, and may cause colic. If you break the nursing interval every few minutes and pat the child upon the back, as our grandmothers did, he belches up air, the tension in his stomach is relieved, and he nurses with renewed vigor. Many perplexing difficulties with breast feeding are overcome by this simple bit of advice.

In instructing the mother as to nursing, tell her the baby does better if he has not only the nipple, but also a little of the areola in his mouth.

How do we know when the baby is doing well—if he is getting sufficient food? The best index, gentlemen, is his *weight.* If he gains on an average of about six ounces a week, no fault can be found with his nutrition.

*Dr. Summerell asks* how often it is advisable to weigh the baby as a routine.

*Answer.*—The oftener the better. I should say at the very least once or twice a week.

*Dr. Summerell.*—That is all right, doctor, but in our country practice the parents have no scales. Have you any idea as to the feasibility of a portable scales?

*Answer.*—One of the men of the Children's Memorial Hospital at home (Dr. Spicer)* has devised an ingenious scales. I have had no experience with it myself, but from his description it sounds quite practicable.

What shall be the diet of a nursing mother? As far as we know the nursing mother may eat absolutely anything that makes her happy and contented. We may disregard totally in this respect the mandates of our grandmothers. If the nursing mother likes vinegar and it agrees with her, let her have it. Whatever she craves, whatever she can digest, whatever pleases her and makes her happy and contented, she shall have. Our sole desire in regulating her diet shall be to fulfil three requirements:

(*a*) She must have enough food. Many a poor woman does not secrete a good supply of milk because she herself is starving.

(*b*) The food must be digestible. The nature of the food depends upon the mother's social condition and her tastes, but anything that she can digest she may eat.

(*c*) Lastly, we must gratify her thirst. Langstein and Meyer dwell upon this point, which seems to me a very important one. The mother normally secretes about a quart of milk a day. Thus she excretes almost a quart of water more than normally. You see, then, that she has every reason to be thirsty. Here is where many mistakes, even by well-educated physicians, are made. The physician takes advantage of this thirst to force extra food. The mother does not need extra food at this time,—her appetite is taking care of that,—but she needs fluid. This should be given as water, tea, broth, or thin soup. How wrong it is to take advantage of her need of fluid by throwing into her body a great excess of starches, such as are contained in thick soups and gruels. She does not need this excess of food provided she is getting her meals normally: she needs simply water.

*Question by Dr. Gilmer.*—Doctor, if a baby is four months old,

* *Amer. Jour. Dis. Children*, January, 1915, p. 70.

could you offer him milk from a mother of a newborn? What is the present idea as regards feeding children milk of a mother whose child is so much younger?

*Answer.*—As far as we know now, such considerations are immaterial. Breast milk is the ideal food, and is infinitely better than any other food that can be offered, no matter how young or old the other baby may be.

## LECTURE X

# DISTURBANCES IN THE BREAST FED

Gentlemen, disturbances of the breast fed also, we prefer to consider as disturbances of nutrition. Just as in the artificially fed child, the symptoms arising are many more than those of simply local gastro-intestinal irritation. The skin, the nervous system, the decreased immunity to infections, above all, the weight curve, show that involvement is *general.*

Just as in the artificially fed baby, we find vomiting, diarrhea, or constipation. When these exert no influence upon the weight curve, we are acting wisely if we *let the baby alone.* However, as you once took me to task as regards the practical importance of these subjects, just a few words about them.

### VOMITING

If the babe is brought for vomiting, the first thing to establish is the duration of the symptom. Is it an acute attack or has it been present for a long time? Acute vomiting may be due to infections, enteral or parenteral, may be associated with disturbances of nutrition or metabolic disorders, may be due to nervous factors which are, as yet, not clear to us, and, of course, in older children may follow the conventional cucumber-watermelon mixture. Often it is due to too much fat.

Chronic vomiting may be associated with chronic disturbances of nutrition, such as decomposition, may occur even in inanition, may be associated with a so-called neuropathic constitution (which we shall discuss in a moment), and may be due to pylorospasm or pyloric stenosis.

**Treatment.**—In our treatment, however, we must adopt the same attitude that we have to the stool. Vomiting is simply a symptom and must be made subservient to the condition of the baby as a whole. If the baby is gaining; if he is well and happy and contented, by all means *let him alone.* Keep your eyes open for errors in technic of nursing, such as overfeeding, irregular

feeding, neglect of patting him on the back, and too rapid feeding; but frequently vomiting persists in spite of perfect and unimpeachable routine. If so, the disturbance is due probably to the baby, the fault lying with a hyperesthetic mucous membrane or to faulty reflexes. No matter what be the underlying cause, if the baby is *thriving*, if he is happy, contented, and satisfied, take the mother into your confidence: tell her this condition occurs so frequently as to be considered almost normal; and explain that from the third to the sixth month it will disappear.

On the other hand, if the baby's nutrition is suffering, we must take notice. Acute attacks will disappear upon treatment of the underlying cause, and require little actual treatment of the vomiting except in older children who have devoured impossible food-mixtures. For them a good stomach washing and a dose of castor oil will be a cure.

In the chronic vomiting also we attempt to treat the fundamental cause, as in nutritional disturbances. Pyloric stenosis may require operation. The spastic vomiting of neuropaths, usually considered a pylorospasm, may be influenced by—

(*a*) Increasing the number of feedings and thus decreasing the quantity in each.

(*b*) Reduction of the fat, and offering as a substitute Keller's Malt Soup or a buttermilk mixture.

(*c*) Anesthesin or novocain, 1/60 grain before meals.

(*d*) Tincture of belladonna, one or two drops with a few drops of paregoric before meals. I have found this very satisfactory.

(*e*) Sodium citrate, 1 to 2 percent; one dram in each bottle has been recommended by the French.

Prolonged boiling of the milk for some minutes may be very successful.

But in all cases don't do too much. Sometimes all that is necessary is to reduce the total quantity and make up for the decrease of food value by an increase in concentration.

## ABNORMAL BOWEL MOVEMENTS

(*a*) In reading text-books you learn that the stool of the normal breast-fed baby is soft, homogeneous, pasty, yellow, and smooth. This undoubtedly is a normal stool. But, gentle-

men, if you examine a great number of breast-fed babies you find that the stools are green, slightly watery, somewhat acid, and contain mucus and curds. These occur more frequently, or at any rate fully as frequently, as those described in the text. In spite of this apparent abnormality the baby thrives, gains persistently, is happy, contented, and satisfied. Under such circumstances, why these stools are not to be considered normal I do not know.

The cause of them is not certain. It may be intestinal fermentation; it may be a neuropathic constitution—probably both. But as long as the baby is happy, contented, and gaining, let him alone, and instruct the mother that this stool is *absolutely normal.* Tell her that it will correct itself by the third to sixth month. If it does not, we can be of service in a way to be mentioned later.

(*b*) **Constipation.**—In discussing the constipation that occurs independent of nutritional disturbance, let me present an idea of my own. I present this to you purely as an idea, not as a fact—one which you may in your leisure moments consider, but not necessarily believe. For my own purpose I divide constipation into two types: these you probably will not find in text-books; but this arbitrary classification has been of great value to me.

(1) The first I call pseudo-constipation. Here the baby is perfectly happy, contented, and thriving. Bowel movements occur perhaps once in two days. They are normal, soft, and homogeneous. The mother complains to you bitterly. She has read in her guide book, or has been instructed by the family physician, that unless the bowels move once a day the baby won't sleep, will be restless, will have colic. As a matter of fact, gentlemen, these symptoms exist only in the mother's mind. They are in the guide book, or in the advice obtained from outside sources, but in *the baby* they rarely exist. He goes sailing along perfectly independent of the anxiety he is causing. Has it ever occurred to you to question the authority which states that a baby *must* have one bowel movement a day? Frequently I have asked myself, "By what right has this author to state definitely that a child *must* have a bowel movement daily." We do not lay down definite rules as to the frequency of

urination. We know that this depends upon many different factors.

The text-books make the statement, but where is their authority? It comes, I presume, from books written in previous times. These books, when written, were founded upon more previous observations; and ultimately, I presume, we should find the statement, like so many we read, to have originated in those medieval, mysterious ages when knowledge was dogma and wisdom superstition. In such cases I tell the mother, "For this baby this condition is normal; don't worry. The intestine is so strong that he is absorbing almost all his food. Very little remains in the bowel, and two days are required for residue to accumulate sufficiently to cause a normal bowel movement." As I say, gentlemen, this idea may be wrong, but it gives good practical results.

(2) True constipation requires more definite treatment. Here the stools are hard and soapy; *i. e.*, truly constipated. They do not adhere to the diaper, and the baby may strain and have pain. No matter how well the child may thrive, if he strains, woe be to you if you tell the mother to let him alone! If you wish to retain your practice, you must suggest definite therapy. How shall we proceed? First, make a careful examination to rule out any organic cause, such as tumor or a congenitally dilated colon. Shall we give physics? This is not reasonable. Physics simply flush out the bowel but do not correct the fundamental cause. Enemas often do more harm than good. When these are repeated daily, the child's rectum becomes sore and he voluntarily restrains himself to prevent the pain. Thus we defeat our own purpose. If the mother insists upon active treatment, an enema of one ounce or more of olive oil may be introduced into the rectum once or twice a week, just before the baby goes to sleep. Instruct the mother to hold the buttocks together, so that the oil remains in the intestine all night, and in the morning, either spontaneously or from a mild suppository, the child will have a soft bowel movement.

As regards correcting the underlying cause, we must attempt, as closely as possible, to simulate the normal. In the intestine of the normal breast-fed child a state of mild fermentation exists. As you remember from the lectures on artificial feeding, such a

condition may easily be produced by the use of fermentable carbohydrate. Offer your patient, after each nursing, an ounce or more of cereal water with 5 percent to 10 percent lactose, or else add from one-half ounce to an ounce after each nursing of a 10 percent watery solution of malt soup extract. In addition, use fruit-juices, and after the third or the fourth month a little apple-sauce. With such simple procedure, these cases respond readily.

So much for isolated symptoms where the babe as a whole has been unaffected.

Now for those which affect the weight curve.

## INANITION

The first of these, as in the artificially fed, we might call "failure to gain." In the normal breast fed failure to gain almost invariably is due to insufficient milk, and so usually is *inanition.* As regards gastro-intestinal symptoms, the stools are of the truly constipated type, being infrequent and hard; but, gentlemen, let me *urge* that in some cases stools are green, watery, and contain mucus and curds. *No worse mistake can be made than diagnosing such cases, as so frequently is done, gastroenteritis from overfeeding.*

Symptoms of general involvement are cessation of the normal gain in weight, pallid, inelastic skin, lost agility, and sunken abdomen. The nervous system is affected. The child may cry continuously, showing neurotic tendencies by scratching the skin of the face and body. Crying, however, may be entirely absent.

*Dr. Woodson* asks: What difference do you draw between inanition and decomposition?

*Answer.*—That is rather a fine point, but perhaps rather a practical one, too.

Inanition is a condition arising from insufficient food. When a child is in a state of inanition, increase his diet and he will gain. When, however, the inanition has proceeded to an extreme degree, then we speak of decomposition. Now if we add food to the diet, a paradoxical reaction will result and the weight curve goes down.

By simple inspection we scarcely can say whether the child is in a state of simple inanition or whether this has proceeded to a mild decomposition. We can tell only by the reaction to food.

As a matter of experience, however, children on the breast, although they may suffer considerable inanition, rarely proceed to decomposition as do bottle babies. It is on the basis of this experience, knowing that the breast baby, perhaps due to the better condition of his tissues, never proceeds to such a severe stage as does the bottle baby, that I am not so careful with their bottles in supplementary feedings.

In the **etiology** of inanition several factors are to be considered:

(1) Insufficient milk may be due to *failure of the supply* of the mother; to retracted nipples; or to fissured nipples.

(2) The child may be *unable to obtain sufficient milk*, due to cleft-palate or harelip. What so frequently is overlooked is weakness in the child. Small twins or prematures may be unable to obtain sufficient nourishment simply from lack of strength.

(3) A so-called neuropathic constitution may be the basis of the trouble, resulting in a distracted physician and a perturbed household. The mother's breast may be abundantly supplied; the slightest pressure may cause milk to gush forth. The child, however, when put to the breast, takes one or two swallows, then seems to show an absolute lack of interest in anything connected with his food, and lies disinterestedly playing with the nipple. How deceptive is this contentment! Were we guided in our feeding solely by the baby's disposition we would completely overlook the warning given by the stationary weight curve.

In the newborn this neuropathy manifests itself by some difficulty in swallowing. The nervous system is incompletely developed, and the child's swallowing reflexes are not as they should be. The child makes clumsy, awkward attempts. During the third or fourth month, however, this constitution shows itself in more persistent form; that is, in a *prolonged loss of appetite.* Do what you will, the little fellow takes no interest in his food. He smiles and is happy, but *will not* nurse. Invariably the distracted mother insists, "My milk is no good;

the baby absolutely refuses it." The unfortunate innocent physician gets a wet-nurse. Added to his worries now are not only the complaints of the mother, but also the domestic infelicity arising from the new acquisition to the family. The baby refuses the breast of the first wet-nurse and she is discharged. Sometimes four or five are employed before the unhappy, by this time well-nigh insane, physician realizes that fundamentally the fault did not lie with the breast milk, but did *lie with the baby.*

4. The failure of the child to gain may in another way be due to insufficient breast milk. He may obtain enough, but lose it again by vomiting. As a general rule, mild vomiting does not produce any marked inanition. The vomiting of the neuropathic child may be severe, however. It is usually associated with a spasm of the pylorus and is spastic in nature. A mother in one of our poorer districts described it best to me by saying, "John vomits the way his pa spits tobacco." In this and in true stenosis of the pylorus, disturbance is grave and severe.

5. Lastly, and not to be classified as inanition, failure to gain may be a temporary affair, resulting from an acute dyspepsia.

**Diagnosis.**—First, is this a case of inanition, or if the stools be dyspeptic, is it a case of overfeeding? Instead of wasting time speculating, simply weigh the baby for a twenty-four-hour period before and after each nursing, and estimate the day's total intake. This simple procedure rather than stool examination makes a definite diagnosis.

Equally important is it to diagnose *the cause.* Retracted or fissured nipples speak for themselves. If the fault be an insufficient supply, the baby, after five or ten minutes, ceases nursing and cries irritably. Examination of the breast shows it to be empty, or if the nursing be interrupted, one finds that the milk oozes from the nipple simply drop by drop.

If the fault lies with the child, observation of the nursing process makes the diagnoses. The clumsy swallowing of the newborn points to undeveloped reflexes. The lack of interest in the older child shows the neuropathic loss of appetite.

Vomiting is recognized by the history and the examination.

**Prognosis.**—In the breast-fed this is relatively good. Rarely does the breast-fed child progress to the stage of decomposition

so easily reached by the bottle baby. Decomposition results only in extreme cases.

**Treatment.**—Treatment depends upon the cause. (1) If the fault lies with insufficient milk, the child may be put to the breast more frequently or else both breasts may be used. If the weight curve does not rise after a few days of this treatment, a bottle may be added after each nursing, the amount depending upon the amount of milk obtained from the breast. As children wean themselves rapidly, *never* give the child the bottle until the breast has been *thoroughly emptied.*

(2) When the fault lies with the child:

(*a*) If it be due to the undeveloped reflexes of the newborn, we must be patient for a few weeks. However, during this time don't allow the baby's nutrition to suffer; and insist that the breast be emptied after each nursing, so that the supply does not fail.

(*b*) If the fault lies with loss of appetite, correction is more difficult. Sometimes a few drops of pepsin with dilute hydrochloric acid, given before each meal, stimulate the appetite. A daily stomach washing may be of value. A lukewarm bath, followed by a cool spray, occasionally gives striking results. In the latter be careful not to shock the child. Babies are very susceptible to cold. Make the spray just cool enough to be mildly stimulating and to make the child breathe deeply; to make him cry perhaps, but under no circumstances to shock him severely. If this is done once or twice a day, a few minutes before meal-times, often the child nurses with considerably more vigor.

During this period of treatment the child's nutrition must by no means be neglected. Here great errors are made. The physician too frequently says, "If this child won't nurse, we'll let him get so hungry that he will have to." Such treatment accomplishes nothing. The child's loss of appetite is not due to his having obtained sufficient food. It is due to the condition of his nervous system. Whether you give food more frequently or less frequently, his appetite will not change unless the underlying fault can be corrected. Under these circumstances, as the baby takes only the slightest amount of food at each nursing, put him to the breast *oftener*, and then, if his

weight curve doesn't ascend, use forced feeding, because there is no reason for his nutrition's suffering during the period that you are trying to overcome his nervous tendencies. The use of a stomach-tube may accomplish a marvelous cure. Lastly, as this neuropathy is inherited from nervous parents, as the baby makes the mother nervous, and the mother in turn makes the baby nervous, at times the only thing we can do is to order a change of environment. If you can get a good wet-nurse, a sane woman who takes a perfectly disinterested sort of interest in the child, results are very gratifying.

(3) In all cases, no matter what be the cause of the inanition, don't neglect the child's water supply. Children suffer grievously from lack of water. In getting small quantities of breast milk naturally they reduce markedly their water intake. In your treatment don't neglect to make up this deficiency.

The other marked disturbance is dyspepsia, which is much like that arising on the bottle.

## DYSPEPSIA

Gastro-intestinal symptoms are vomiting, regurgitation, diarrhea, *anorexia*, flatulence, tympanites, and colic.

General symptoms other than gastro-intestinal are *cessation of gain*, change in the quality of the skin, slight fever, nervous reactions, as sleeplessness and unrest, and decreased immunity to infection.

**Etiology.**—Several factors may be concerned:

(1) Alimentary influences up to the present have been considered most important.

*Alimentary Influences.*—(*a*) Overfeeding is given the first place. Gentlemen, I don't want to be too radical, but I believe that more and more we are beginning to doubt the importance of overfeeding. As the importance of constitution grows in our mind, as we recognize the neuropathic type of child and other types, too, as we recognize fundamental differences in the baby himself, just so much are we decreasing our emphasis on the outside factors. Irregularity of feed-

ing in our mind is perhaps much more important than is overfeeding, and let me remind you that irregularity of feeding is due frequently to *underfeeding* rather than to overfeeding. Indeed, we are beginning to doubt whether many cases do result from overfeeding. So great is the adaptability of the mother's breast to the baby's demands,—when the baby wants more, more milk is secreted; when the baby wants less, less is secreted,—so great is this adaptability that if the child be nursed regularly every four hours it is a question whether many mothers *can* overfeed their babies. Perhaps overfeeding is a factor when an undernourished infant is put to the breast of a fine, healthy wet-nurse. Before the baby has adapted itself to the breast, and vice versa, often too much milk is taken.

Such statements are, of course, heresy, gentlemen, but weigh the baby before and after nursing and see for yourselves.

(*b*) Of alimentary factors, we believe irregularity of nursing to be most important, but don't forget *inanition* may produce a picture identical to dyspepsia.

(*c*) Foreign substances secreted in breast milk and causing this dyspepsia we believe very rare indeed.

(*d*) Shifting proportions of the different elements, as, for example, too much fat, are described. Undoubtedly some breast milk contains more fat than the average. As the stools of many of these children, however, are typically fermentative, frequently do I wonder whether perhaps too much sugar is not being secreted. In all cases very little scientific evidence proves that disturbances arise from these sources. We may learn more later. As I mentioned in our last lecture, one will make fewest grave errors if, for the present, he considers that invariably breast milk is perfect in quality and disturbances are due only to changes in quantity.

(2) **Infections.**—The more dyspepsias we see on the breast, the more do we realize the fundamental influence of in-

fection. A baby has been thriving, becomes infected with a nasopharyngitis, a bronchitis, an otitis, or a cystitis, and a dyspepsia results. When the infection has run its course, the intestinal tract corrects itself, fermentation ceases, and the stools become normal. In this type, frequent errors are made. The mother says the milk is not agreeing with the baby. The physician may prescribe a wet-nurse; may take the baby from the breast; may order medicine for the child; may diet the mother; and in spite of all treatment, improvement occurs. Why? Improvement does not result from the therapy; it occurs because the child has recovered from the infection. In all cases of dyspepsia on the breast don't neglect searching for parenteral infections.

(3) Our old enemies, overclothing, overheating, improper care, overcooling, are, of course, never to be overlooked.

The **symptoms** depend to some extent upon the cause. Those due to alimentary factors develop gradually. Nervous changes, with disturbed sleep and restlessness, manifest themselves first. Later symptoms of the gastro-intestinal tract develop. General symptoms and fever are, as a rule, not severe. The type due to infection appears rather suddenly in the previously thriving child. General symptoms and fever are more in evidence than in the former.

The severity of the reaction and the course depend upon the child's constitution—the better the constitution, the less the reaction. The alimentary type is progressive and often ends in anorexia. The infectious type is short and ends in a cure, with recovery from the infection.

**Diagnosis.**—The diagnosis is made from the history.

**Treatment.**—The treatment is relatively easy where alimentary factors can be corrected. Where infection is the basis of the disturbance, wait. In all cases, and in that mentioned at the beginning of the lecture, powdered casein is of value. Formerly this could be obtained as a powder. Since the war I doubt if it is obtainable, but we may make it by getting the curds of milk and putting them through a sieve. You remember that casein makes the intestine alkaline, and as most of these

diarrheas are of a fermentative nature, casein is ideally suited to our requirements. Give it in doses of one or two teaspoonfuls after each nursing, and increase until you obtain the desired results. Albumin milk may work wonders in small doses after nursing.

One must never neglect the general care of the child, and inquire earnestly into the conditions in the household, clothing, and general hygiene.

One danger leads to serious complications. The mother or the physician, not recognizing that an infection is the cause, lays great emphasis upon the importance of the breast milk. Something must have affected its quality. Therefore we take the baby from the breast and starve him until the milk has corrected itself and until the stools become normal. Gentlemen, all that we have accomplished is to add to our patient's troubles the damaging influence of hunger. Frequently he gets better with this treatment, but this change is due to cessation of the infection. Don't make unnecessary use of hunger. Children have so much intelligence,—often so much more than we,—if you weigh the baby before and after nursing you will find that instinctively he cuts down his diet. You will find that he drinks far less during these few days than ordinarily. It is my custom simply to put the child to the breast, allow him an interval shorter than usual,—five minutes, for example,—and to repeat this at the regular feeding time, but never let him hunger markedly. By this procedure you will find that during these few trying days the baby's general nutrition is maintained.

From the above you see how unnecessary in many cases is a wet-nurse. The fault lies so frequently with the baby, rather than with the milk, so frequently with outside factors, such as infections, rather than with the mother herself.

Just one word about severe diarrheas occurring in the breast fed. Breast-fed children, rarely it is true, but still definitely, do develop symptoms almost identical to the alimentary intoxication of the bottle baby. Our previous ideas were that a toxin was secreted by the breast milk. I believe this has been disproved. I doubt if people ever find human breast milk definitely poisonous to the child. However, we are learning to recognize other factors. We are learning that parenteral in-

fections; true intestinal infections, such as dysentery; or overheating may be the basis of the trouble, and, lastly, we have learned that children in states of severe decomposition, when given large quantities of any breast milk whatsoever, go down and die with the severest alimentary symptoms.

The treatment is identical to that of the alimentary intoxication or true infections of the artificially fed.

This finishes, gentlemen, infant feeding. There are many, many more phases of this interesting subject which I should like to discuss with you. Time, however, forbids. If you have followed me carefully you will perhaps have obtained some idea of the methods of our Middle West, as I understand them. I do not urge these exclusively upon you. I trust that you have become interested and will investigate the teachings of the great men all over this country of ours. After you have obtained a comprehensive view of the whole field, select the method which pleases you most, or, better yet, you may be in a position to select from the different teachings many points of value, and I trust that you will use them all, no matter what their source, to aid sick and suffering children.

# CLINICS

## CLINIC I

Gentlemen, I asked you to bring normal babies to the clinic today for two reasons: First, no satisfactory work in infant feeding can be accomplished without a thorough understanding of the normal infant, who represents the ideal for which we are striving. Second, you have learned that from the viewpoint of infant feeding it is wiser to consider the artificially fed baby as a sick baby. For this reason, no matter how well he may seem, before you prescribe feedings you must obtain an accurate history and a careful physical examination.

(Normal children are brought by Dr. J. W. Long (Greensboro), Dr. F. Raymond Taylor (High Point), and Miss Powers (Winston-Salem).

Dr. Long's patient demonstrated.

Gentlemen, just step up and feel the texture of this skin. Put your hand on it and notice its delicacy, its velvety softness. The first touch, more than the first glance, diagnoses the breast-fed baby. Notice the fineness, the elasticity, and the fullness. Note the smoothness, the splendid state of nutrition, the delicate pink color. Feel the subcutaneous tissue. Strange that the first thing we see in looking at any patient is the skin, and yet in our examination it's the most neglected of all organs. In future clinics we shall learn what marked changes in elasticity, fullness, softness, and color it undergoes during the development of disturbances of nutrition. Indeed, with eyes blindfolded—practically by palpation—we can diagnose such disturbances.

In this normal baby notice the well-developed muscles—their normal tone, neither too rigid nor too flaccid. Note the abdomen, not retracted, not bulging, just about the level of the thorax. We haven't this baby's weight, but he looks approximately 16 to 18 pounds, which would be normal for a baby of about six months.

Above all things, notice his contentment, his happy smile,

his fearlessness. Note how he reaches for my watch and wants to play (Figs. 32 and 33).

Fig. 32.

Fig. 33.

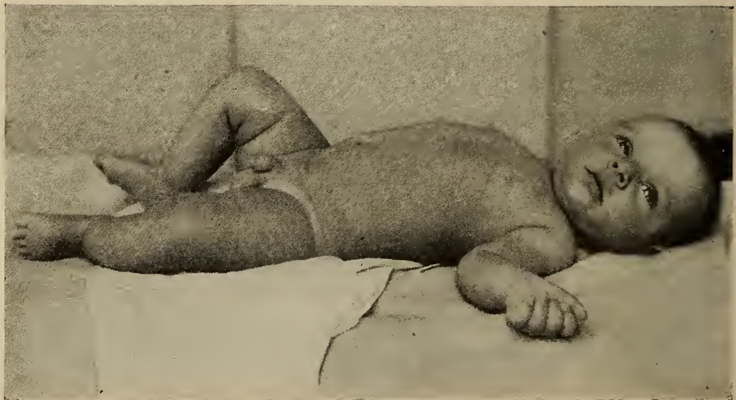

Fig. 34.

Note how joyfully he stamps and kicks and waves his arms. I clap my hands; he looks at me with a somewhat inquisitive, rather pained expression; he's disappointed in me; but he's normal (Fig. 34). He doesn't shriek with terror as would a baby with a neuropathic constitution.

Having satisfied ourselves as to the state of his nutrition, we ask, "Has he developed normally?"

I see by Dr. Long's expression that he thinks we have abused his protégé sufficiently; so let's persecute this one of Dr. Taylor's. I wish you gentlemen would come up and examine him, and then go to your seats and write on a slip of paper your estimate of his age.

Well, for such a superficial examination, you have done better than you deserve.

In estimating a child's age, you must take into consideration many points. We reason as follows: First, is he a newborn?

No. The skin has not the characteristic bright-red color of an Apache Indian; it is not covered with vernix caseosa, and baby's size, of course, contradicts such an assumption. Again, the skin of the newborn desquamates for about ten days. This skin shows no trace of desquamation. The breasts in all normal children secrete during the first week, sometimes a few days longer. When *these* breasts are compressed, no trace of fluid exudes. Again, in normal babies the cord falls off within four days. In this child not only has the cord disappeared, but the navel has also healed perfectly. This shows him to be over three weeks.

Has he reached the normal development of a child of two to three months?

*Question.*—Mother, does he recognize you? Does he smile when he sees you? We don't need an answer. That smile speaks for itself.

*Question.*—Does he notice things? We'll try him. See how the eyes follow my flashlight! See the interest he takes! He follows not only with the eyes, but with the whole head. All this confirms our opinion that he is at least two to three months of age. Interesting, is it not, that when a baby *first* starts to notice external affairs he follows with only one eye, and so during the first four to eight weeks strabismus is normal? By the

end of the second month, however, he follows with both, and with the head too. So this baby easily has passed eight weeks (Figs. 35 and 36).

Fig. 35.

Fig. 36

Is he over three months of age?

Does he hold up his head?

He does this very well, either when raised by the shoulders from the table or when lying on his stomach. So he is three months or more. At three months tears appear for the first time, as does drooling, and coördinate movements of the extremities show a beginning of voluntary muscular control.

*Question.*—Mother, does he recognize familiar noises?

*Answer.*—Yes, he knows my voice and also his father's.

That shows he must be four months or more.

Does he sit up yet? Well, he's making a brave attempt, but I guess it's too heroic a task. And he has no teeth either. At six months a baby begins to sit up, shows two lower central incisors, and has doubled his birth weight. From this child's size he must be almost six months. But he doesn't sit up, and so I judge him to be perhaps five months, or a little more.

*Question.*—Is that right, mother?

*Answer.*—(Proudly.) He is four months and three weeks.

Well, here we have not only a baby normal in every respect, but also one who is a little ahead of time; so, mother, you may be proud of him.

It will be very interesting to watch the development of this young man. When he reaches the dignified age of nine months, if supported, he will attempt to stand, and his vocabulary will include such choice words as "pa," "ma," and "goo." Nine to twelve months may find him attempting to walk. At the end of the first year he will treble his birth weight and will have six to eight teeth. The large anterior fontanel will close between twelve and eighteen months. The posterior, as you know, is closed at or shortly after birth.

You may wonder what all this has to do with infant feeding. Simply this: If the baby is not normal as regards his physical and mental development, *you must* make allowance in your formulas. If you limit yourselves to rules and regulations which concern themselves only with baby's age or his weight, you will meet with unavoidable failure. Baby's *tolerance to food* is the *vital* factor, and this you estimate by careful history and by conscientious physical examination. As a rule, the more deficient the child's physical development, the less will be his *tolerance*.

If we do our work thoroughly, we should examine every normal baby as carefully as we do a sick one. Time prevents this morning, but, nevertheless, I am going to take just a moment to examine the heart. I advise you in all cases, in addition to general inspection, no matter how healthy or normally developed the child may seem, never to neglect this. You will find congenital heart lesions not uncommon, and from my own experience I believe more and more that these lesions are important factors in influencing the baby's nutrition and predisposing him to disturbances.

I think we have abused this child's good nature sufficiently. Let's see the next.

### CLINIC I.—BABY 1

Brought by Dr. W. T. Meadows (Greensboro)

*Question.*—Doctor, is this baby to be demonstrated as a well baby or as a sick one?

*Answer.*—He has been breast fed until the present, and up to three weeks ago had been doing nicely. Since then he's not been thriving. I saw him for the first time yesterday, and suggested that the mother bring him to the clinic.

**Discussion.**—Good! Here then we can demonstrate the methods of history taking. I'll go over this one in detail to show the procedure. After this I'm going to ask you gentlemen to take these histories in advance, so as to save time. Before starting, however, let me impress upon you that in all our work we are going to adopt the attitude of the pediatrician, the children's specialist, rather than that of the general practitioner. We are not simply going to say, "What's the matter with this baby?" and offer a little medication, but we must use every means at our disposal to find out with "*just what sort*" of child we are dealing. We cannot hope for success in our feeding unless we know something of the *general make-up* of our patient, and this knowledge we obtain first by careful history, and second by conscientious physical examination.

*Question.*—Doctor, will you please take this card and fill it out as follows: On the upper left-hand corner write the baby's name; on the upper right, his age.

*Question.*—Mother, how old is the baby?

*Answer.*—Just four months and one week.

The first questions in this history are those concerning the family. The influence of heredity must never be overlooked. Doctor, will you kindly write:

**Family History.**—*Question.*—Mother, are you in good health?

*Answer.*—Yes; I didn't feel very strong just before the baby came, but I'm all right now. I'm always pretty well.

*Question.*—Is the baby's father in good health?

*Answer.*—Yes, he's never been very sick in his life except once.

*Question.*—What did he have?

*Answer.*—Typhoid fever.

*Question.*—Are there any nervous sicknesses in your family? Have any relatives—your father, mother, brothers, or sisters, or your husband's brothers and sisters or parents—ever been in any institution for any nervous sickness?

*Answer.*—No; there have been no such sicknesses in the family, or at any rate none that I know of.

**Discussion.**—The reason I asked this is that many children are predisposed to nervous trouble by heredity. It's hardly necessary to mention that severe nervous disease, or alcoholism in the parents, often leads to epilepsy or nervous degeneracy in the child, and this latter, in its turn, frequently gives rise to nutritional disturbance.

*Question.*—Have you or your husband, or any of your relatives, or any of your husband's relatives, ever had any lung sickness?

*Answer.*—There has been no severe lung sickness in our family. Both my husband and I at times have had severe coughs, but they have been of short duration, and the doctor said they were simple bronchitis.

**Discussion.**—We are particularly interested in lung diseases because we know tuberculosis in the parent is a frequent cause of feeble, poorly developed offspring, and, secondly, even though these children may not be born with tuberculosis, in such an environment they readily become infected. Of course, tuberculosis is a great factor in predisposing to nutritional disturbance.

The next points to be considered in the family history are the

number of children, the health of these children, and the number of miscarriages.

*Question.*—How many children have you?

*Answer.*—This is the only one.

**Discussion.**—Gentlemen, look out. Keep your eyes open for the only child; he's always exceedingly difficult to examine. Usually—excuse me, mother—he's just a little bit spoiled. He likes his own way, and looks upon the doctor as a decided enemy. See! He's preparing for the battle. We must handle him with great care and discretion.

*Question.*—Have you lost any children?

*Answer.*—I lost two of colitis.

*Question.*—How old were they?

*Answer.*—One was nine months and one two years.

*Question.*—Have you had any miscarriages?

*Answer.*—None.

**Discussion.**—We're glad to know that, because miscarriages make us at any rate *think* of syphilis. By no means has every mother who suffers from miscarriage syphilis, but if we should get a history of miscarriages as follows: for instance, one, say, at four months, another one a little later, say, at six months, a third one a little later, for example, at eight months, and then perhaps a baby born dead, we are justified in being very suspicious of congenital syphilis, and, as I tried to emphasize before, in infant feeding we must try to keep our eyes open for every influence that possibly can have been exerted upon the baby.

This child seems to have a perfect family history. Nothing from this standpoint will influence our feeding orders. We next ask if any factors in his past life are of importance.

**Past History.**—*Question.*—Mother, were you well before the baby was born?

*Answer.*—I suffered from headaches and backache and felt a little weak, but never had any serious complaint.

*Question.*—No kidney trouble or convulsions?

*Answer.*—No.

*Question.*—Is this a full-term baby, or did he come too soon?

*Answer.*—He was full-term.

**Discussion.**—We are interested in knowing this because pre-

matures are far more susceptible to nutritional disturbances than are full-term babies, and must be handled with special care. Of particular importance is the next subject:

*Question.*—Was the *labor* difficult? Was there any serious complication? Was it necessary to use any instruments?

*Answer.*—The doctor told me my case was normal.

*Question.*—Did the baby cry as soon as he was born, or did the doctor have any trouble with him? Did the doctor tell you that he was suffocated, or blue, or that he was almost like dead?

*Answer.*—No, he cried right away and seemed all right. Dr. Brown said he was a fine baby.

**Discussion.**—These are important questions. I ask about difficult labor and about instruments because these complications may cause direct cranial injury with a resulting meningeal hemorrhage, or by producing a great rise in blood-pressure from asphyxia may indirectly cause the hemorrhage. Such a hemorrhage injures the brain. As a result, the child does not develop properly, and although he may show no marked symptoms at first, by the time he reaches five or six months of age he presents a grave and most distressing picture. He is very backward, his mentality is deficient, his limbs are rigid, and often crossed like scissors. In the clinics which are to come I haven't the slightest doubt that we shall see such cases of so-called Little's disease, and you will learn how this condition affects the general nutrition of the child. Children with mental defects are very difficult to feed, and many of them suffer extreme inanition from loss of appetite.

*Question.*—How much did he weigh at birth?

*Answer.*—We had no scales at home, but Dr. Brown estimated him at 11 pounds.

**Discussion.**—He certainly was a fine youngster. Most babies average about 6 to 8 pounds at birth.

*Answer.*—All our North Carolina babies are larger than that.

*Question.*—What sicknesses has the baby had?

*Answer.*—He's had nothing but an occasional cold.

*Question.*—Has he ever had measles or whooping-cough?

*Answer.*—No.

*Question.*—Does he get very sick with these colds?

*Answer.*—No. He doesn't get sick at all.

**Discussion.**—In this way we learn first the diseases which have influenced this child's life. We are particularly interested in measles and pertussis because they so often predispose to tuberculosis. Secondly, we learn the nature of his resistance. The better the condition of nutrition, as a rule, the more perfect is the resistance.

*Question.*—Has the child developed in the right way?

**Discussion.**—This is hardly a question that mother can answer. We can learn this more satisfactorily in our examination. Inspection of this apparently normal baby and the history of the well-developed resistance to infection make us think that he either has been breast fed or has been fed perfectly on the bottle. This brings us to the subject of feeding.

**Feeding History.**—*Question.*—How has the baby been fed?

*Answer.*—He has been breast fed up to the present.

*Question.*—How often have you been nursing him?

*Answer.*—I was giving him the breast every two or three hours.

*Question.*—Was he satisfied with it? Was he gaining?

*Answer.*—He seemed going nicely until about two or three weeks ago. For the last two weeks, however, he has been peevish and irritable. He hasn't been gaining, and has been very constipated. He won't take the breast any more, and I've given him a little sugar water between meals. He likes that pretty well, but he vomits a lot.

*Question.*—How often do his bowels move?

*Answer.*—Well, they don't move every day unless I give him an injection.

*Question.*—When they move, are they hard or soft?

*Answer.*—They are usually soft.

*Question.*—Let's see if this is correct. Here is a baby who was well up to some weeks ago. Then he became cross, irritable, constipated, stopped gaining, didn't nurse as well as previously, and didn't seem contented. Is that right, mother?

*Answer.*—Yes.

**Discussion.**—Now, gentlemen, following the feeding history, we take the present complaint to learn if the child has been feverish, has been coughing, sneezing, or showing any other abnormal symptoms.

**Present Complaint.**—In this case the feeding history probably will be synonymous with the present complaint.

*Question.*—Does he show any other symptoms, like fever, or have you noticed anything else the matter with him?

*Answer.*—No, that is all we noticed.

**Physical Examination.**—*Question.*—Mrs. Peck, what is the baby's weight?

*Answer.*—Eleven pounds two ounces. Temperature, 98° F.

**Discussion.**—This would be a good weight for a baby who weighed six or seven pounds at birth. But if he weighed almost eleven pounds he certainly hasn't gained very much.

Gentlemen, I'm going to examine him very carefully to show the methods. No matter how convinced we are that it's simply a feeding case, we never should establish a diagnosis before making a thorough examination. We must rule out every other possibility and arrive at feeding more by exclusion than in any other way.

Always remember, before confining yourself to any local examination, to look at the *baby as a whole.* Here we see a fairly nourished infant. He doesn't look so very sick; he doesn't look unhappy—you notice he smiles at us, but the smile is a little feeble. Notice this somewhat flabby, inelastic skin; the color, too, isn't that of the normal children we just have examined; it has the slight muddy tinge which we know to be an important symptom. I pick it up and it wrinkles rather easily. It seems softer than the skin of the other children. The subcutaneous tissue is less firm and allows the skin unusual motility. Notice the lack of tone of the muscles. They feel flabby. All these findings are suggestive of a disturbance of nutrition.

As a routine, however, we examine every part of the body. The osseous system, you know, is very important in infants. We feel the large fontanel, which, of course, is widely open, but it's neither sunken nor under tension. We feel for softness in the bones behind the ears—craniotabes. We find none. We feel for beading of the ribs where they join the sternum—the rosary. This, too, is absent. Both of these symptoms are very suggestive of rickets. As a routine, we examine all the lymph-nodes—the cervical, the axillary, the cubital, and the inguinal.

We find nothing except a few the size of a pea in the posterior portion of the neck. The more children we examine, the less significance we lay upon a few palpable nodes.

Next we seek abnormalities about the head. The eyes, ears, and nose show nothing. Everything is normal. You notice we let the mouth and throat go for the present, because this child is so good we don't want to make him cry. It's a good routine to leave the mouth and throat examination for the last.

We feel for rigidity of the neck—it's absent. We carefully percuss the heart and lungs and auscultate. Everything is negative. We feel for an enlarged liver and spleen. The flaccidity of the abdominal muscles makes this easy. I don't feel the spleen. The liver reaches one finger below the costal margin. This is of no significance. There are no other abnormalities. We examine the reflexes—the triceps, knee-jerk, Achilles, and abdominal reflexes. They are all brisk, equal, and show no definite findings. So in this case our physical examination is absolutely negative.

Gentlemen, by no means does this finish the examination. In every case where anything in the family history makes us in any way suspect lues we never must be satisfied until we have a Wassermann, and that means a Wassermann on the mother as well as the baby. The Wassermann of the parent is perhaps the more accurate.

Again, where the child in any way has been exposed to tuberculosis, we must demand a von Pirquet test. Where anything, such as extreme pallor or enlarged spleen, suggests blood diseases, we examine the blood, and the stool for hook-worm, and, of course, as a matter of routine, where there is the slightest suggestion of trouble, or even the slightest possibility, never omit a urinalysis. Cystitis is very common, but frequently overlooked.

As to methods of obtaining urine. In a boy it is simple. Simply attach a bottle or rubber glove with adhesive. In a little girl it's more difficult. Sometimes a cool bath will be followed by urination. An enema often causes the child to pass water, but, of course, this may be mixed with the stool. Letting the child sit upon something cold, as a saucer or plate, may cause her to urinate. Massage over the bladder is fre-

quently successful. A rubber glove may be used. An ingenious apparatus by Dr. James Leach, one of the fellows at our hospital (Fig. 37).

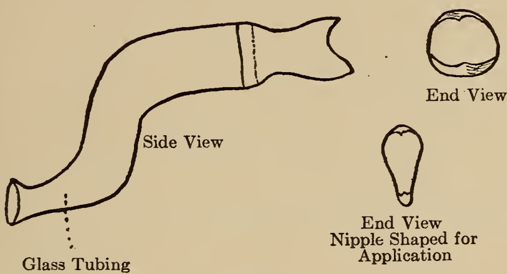


Fig. 37.

This device consists of a rubber nipple from a nursing bottle, a suitably curved piece of glass tubing, about three feet of soft rubber tubing, and some adhesive plaster.

The nipple, preferably an old discarded one, because of its softness, is cut curved, forming a concave end, with the lower portion forming a tongue-shaped cup. The other end is fastened to the glass tubing. This tubing is curved so as to fit between the thighs, and rests on the bed, preventing dragging, forming a ready exit for the urine, and preventing backing up and leakage. The rubber tubing carries the urine to a receptacle attached at the side of the bed, and the whole is held in place by means of adhesive plaster.

In applying the apparatus the labia majora are retracted, the lower cup-shaped portion is applied just within the fourchet, and the rest is brought up, inclosing the labia minora and urethral orifice within the nipple. The labia majora are then closed over this and held together with adhesive plaster. The whole device is further secured to the vulva by means of a flange-shaped piece of adhesive wrapped around glass tubing.

**Diagnosis.**—Time, this morning, prevents our going into an extensive discussion of the diagnosis. I believe the great majority of men will tell you that babies fed every two to three hours are suffering from overfeeding. Personally, as regards this point, I am somewhat of a heretic. Understand, however,

that many pediatricians will not agree with what I'm about to tell you. I believe, nevertheless, that many children who are nursed every two to three hours really are underfed. I believe that they are nursed so frequently because the mother hasn't sufficient breast milk, and tries to ease the child's discomfort by placing him more frequently to the breast. I believe, in these cases, if we *add* food rather than reduce it, we get better results. The first thing, however, is to determine *definitely* whether the child is receiving too little or too much. The history of discomfort, the failure to gain, the constipation, the refusal of the child to take the breast, all point to insufficiency of the supply of milk, and we make a tentative diagnosis of *inanition*.

**Treatment.**—Mother, I wish you would place this baby to the breast regularly every three hours—seven times in twenty-four hours: First at 6 o'clock in the morning, then at 9, 12, 3, 6, 9, and once during the night. If the baby won't nurse, give him absolutely nothing until the next nursing time. Let him nurse for twenty minutes. Under no circumstances give him any more sugar water. Bring him back to us next week. We'll weigh him accurately, and then shall know just exactly what he is doing on your breast milk. Be very careful to give him nothing in addition to the breast, and be absolutely sure to come next week. Good-by!

**Discussion.**—Gentlemen, in private practice we wouldn't wait so long for the reaction,—that we could determine within a few days,—but as these clinics are held only once a week, I think it will be desirable to wait to demonstrate the changes. I feel quite confident that this baby will not gain and that we shall have to add something to the diet in addition to the breast milk. In all children who are to come we necessarily must wait one week for the reaction, but remember, in private practice don't wait over two or three days.

## CLINIC II.—BABY 1

*Age.*—Four months two weeks.

Mother says the baby is no better. He frets after each nursing, seems peevish all the time, and very hungry. He suffers greatly with colic and is constipated.

*Question.*—After he has finished nursing does he still fret?

*Answer.*—Yes; he never seems satisfied at the breast, and I have a terrible time making him wait until the full three hours are up, but when he gets to the breast he doesn't like it.

*Question.*—Have you kept him regularly on the three-hour schedule?

*Answer.*—Yes; but it's been very difficult.

*Weight.*—Eleven pounds two ounces. No gain during the week.

*Temperature.*—98° F.

*Examination.*—He presents just exactly the same appearance as last week. He's a little flabby and pale and apparently undernourished.

**Discussion.**—As he hasn't gained this week, and in the absence of any factor other than food, we feel sure of our *diagnosis of inanition.* I should add a bottle right now, but just to be *absolutely* sure that mother is secreting an insufficient supply of milk let's wait a few days longer. You remember that this child drank sugar water between meals. Possibly he was so spoiled, due to the sweet taste of the water, that for this reason he has refused the breast.

**Directions.**—Let's try him just one week more, and then, if he doesn't gain, we certainly shall be justified in adding a bottle. There is a bare possibility, though, that by adhering rigidly to our routine the child will nurse vigorously enough to increase the supply of breast milk. Be sure to come back next week, mother.

*Question by Mother.*—But doctor, what shall I do for the colic? Shall I have my breast milk examined?

*Answer.*—All right, mother, give Dr. Meadows a specimen of your breast milk.

**Discussion.**—Gentlemen, you have heard about qualitative changes in breast milk, but examination will make mother feel easier. Personally, I'm convinced that this colic is due to *hunger*, as the child hasn't gained the required amount. However, to make sure, let's wait another week and see exactly what he's doing.

*To Mother.*—I think we can aid the baby greatly if you'll just follow our instructions for this next week. See if you

can't put up with his crying for a few days and then we'll fix him.

*Question by Dr. Summerell.*—Have you any babies of your own, doctor?

*Answer.*—No; but I see by your smile that you think my ideas will change.

*Dr. Woodson.*—Doctor, it's all very well in clinic to tell these mothers, "If baby is crying, let him alone," but we can't do that in practice. When we are called up at 3 A. M. and father says, wearily, "I never knew I could walk ten thousand miles in one evening," we've got to say something more to him than simply "weigh the baby."

*Answer.*—Gentlemen, I accept the reproof. The reason I didn't lay much stress upon the colic is my earnest desire to teach you to put the *welfare of the baby above the relief of any individual symptom.* As regards the immediate relief of colic, an enema may save the day, or, rather, the night. The enema can be given in the form of salt solution,—a teaspoon of salt to a pint of water,—or, if this is not satisfactory, as a soapsuds enema. *One* drop of essence of peppermint in a teaspoonful of sweetened water, by causing internal warmth, will sometimes satisfactorily relieve pain; or you may give a few drops of pepsin. Apply hot-water bags or hot flannels to the abdomen, and lastly, if the child *must be relieved,* give him a few drops of paregoric, and repeat in an hour or so. But, gentlemen, *the point to be remembered is this:* While advising this treatment, always ask yourselves, "Is this truly a case of intestinal colic?" Don't neglect to apply a little pressure to the ear; don't neglect to ask for a urinalysis as soon as possible. The colic, after all, may be simply an otitis media, a cystitis, or a meningitis. Second, ask yourselves, "Is this truly a case of colic from indigestion, or is it simply the *pain of hunger?*" For this latter reason I lay so much emphasis on the weight. Lastly, if it's a digestive affair, is it due to too much perfectly good food or is it due to an excess of one individual element of a food? We think that some colic in the breast fed is due possibly to excessive carbohydrate in the breast milk. So, gentlemen, although the relief of the immediate pain in a child is important and not difficult, don't forget that, after all,

the essential thing is to arrive at the underlying factor and make a proper diagnosis.

*Question by Dr. F. Raymond Taylor* (High Point).—Doctor, as long as we are on the subject, would you mind telling us just what is three months' colic?

*Answer.*—Three months' colic is a term applied by the laity to the colic which occurs in breast-fed babies who seem thriving, however, in every way. It lasts usually from three to six months, the baby suffering apparently from considerable indigestion, and showing green, watery, fermentative stools. The etiology is not definitely known. I don't know of much scientific work upon it, as the condition is not of grave significance; the children all outgrow it. Two factors may be concerned: First, some evidence points to the fact that it occurs in nervous children—that it is due not to the milk, but to the baby. These neuropathic children, for some reason or other, do not seem able to control fermentative processes in the intestine as do normal children. The second factor, although not proved, might lie in an excess of sugar in the mother's milk. Certainly the stools of these children point to fermentation.

The practical treatment of the colic, in which you gentlemen have shown yourselves so interested, is along the lines just laid out. To strike at the cause, however, we attempt to overcome intestinal fermentation. This can be done by giving a little powdered casein or powdered curds of milk after each nursing, or, by what sometimes works wonders, namely, a little albumin milk with no sugar, after the breast. This food, with its high protein, low salt, and low carbohydrate, by tending to stimulate putrefaction in the intestine, sometimes accomplishes surprising results.

In this case I'm positive that the crying is from hunger. In private practice I should have added a bottle to the diet several days after first seeing the child, but, unfortunately, the clinics come only weekly, and I'm very anxious to show you the different reactions of the weight curve uninfluenced by treatment. In this case the curve has remained horizontal, so we'll make mother put up with the noise just one week more.

### CLINIC III.—BABY 1

*Age.*—Four months three weeks.

Mother says the child has not improved in any way, is still fretful, peevish, irritable, and doesn't take the breast well at all. No additional symptoms or complications have been noted. Bowels are constipated. Mother says that she hasn't much milk, and the baby cries all the time. In addition, the child shows some aversion to the breast and is not nursing well.

*Weight.*—Ten pounds fourteen ounces, showing a loss of four ounces during the week.

*Temperature.*—97.8° F.

*Question.*—Mother, do you notice that your supply of milk is much less than it used to be?

*Answer.*—Yes, indeed, the baby doesn't get much from the breast any more.

*Directions.*—To confirm our diagnosis of inanition,—this loss is by no means sharp enough to suggest any of the graver disturbances,—we'll add a bottle after each nursing. Let's figure that the baby will drink about two ounces, and so if he's four and one-half months old we'll be absolutely safe in ordering a mixture of—

| | |
|---|---|
| Milk | 9 ounces |
| Water | 6 ounces |
| Sugar | 4 teaspoonfuls |

Seven bottles.

*To Mother.*—Mother, have you ever fixed up any feedings before?

*Answer.*—No.

Well, then, let me tell you just exactly how to proceed: In one corner of the kitchen put up a shelf, or else set aside a corner of the kitchen table. Use this exclusively for baby's food utensils, and don't mix them with anything else in the kitchen. First, get as many bottles as there are feedings during the day, or even a few more. Next take some whole milk, shake it thoroughly so that the cream is well mixed, and in your case pour out nine ounces. Add six ounces of water and four teaspoons of sugar. Boil thoroughly for a minute and pour at

once into seven bottles. This makes about two ounces in each. If you let the mixture stand in an open pitcher for any length of time, it will spoil.

Get a few cents' worth of sterile cotton and cork the bottles, keeping the unused cotton in its original package. Then you are through for the day. Of course, you must keep the bottles cool, either in the ice-box or, if you haven't one, in the well or in the stream.

Nurse the baby for ten to fifteen minutes and then give a bottle. Let him have this five or ten minutes. If he takes it and is satisfied, well and good; but if he doesn't finish it in ten minutes, take it away from him. By all means nurse him first and give the bottle afterward, because if you give the bottle first, he will wean himself more easily. This way will be more likely to keep up your milk supply.

Put the nipple on the bottle only at feeding time. Those not in use can be kept in a covered jar of boiled water with a little boric acid or soda.

As regards washing the bottles: you may do so either at once or the next morning. If the latter, because milk sticks to the inside, get a bottle brush, scrub them with yellow soap, and rinse them thoroughly afterward. If you wash them directly after using, keep the clean bottles in a jar with sterile water and a little soda. When you clean the nipples, be sure to invert them. It goes without saying that if the baby drops his bottle on the floor you must take out another nipple.

When you give the baby his bottle, be sure to see that he really gets it. Don't leave him all alone to go to sleep, but do your best to hold it and give it to him with the same care that you would if you were nursing him. Hold the bottle so that he really gets milk, not air.

Warm the bottle just before giving it to him by putting it in a little warm water, but if you take the baby out for the day, don't make the mistake of heating the bottle before you go. Wait until feeding time or else the milk will spoil. You can do a good deal toward keeping the bottle cool by wrapping it thoroughly in a newspaper before you go out.

Let's see him again next week, and when you come back tell us how he is. We'll weigh him and see how he has responded.

*Question.*—Have you understood everything, mother?

*Mother.*—If I am to give seven bottles with two ounces, should I add five or six ounces of water?

*Answer.*—Six ounces, because about one will be lost during the boiling.

**Discussion.**—It's always a good idea to add more water than you need on account of the boiling. You notice the simplicity of the formula? It required no calculation on my part whatsoever. It consists simply of two-thirds milk and one-third water, with a little sugar.

In cases such as this I prefer to add a bottle after each nursing, but when such order works hardship on a mother who is weak or who must work, we may give breast and bottle in alternate feedings.

Whenever I order a bottle I start orange-juice. You may dilute it with water, or give half a teaspoon of the pure juice. In either case the baby may vomit the first dose or have a little colic. Don't pay any attention to these symptoms, but give it again the next day, and in a short time you'll find baby taking it nicely.

## CLINIC IV.—BABY 1

*Age.*—Five months.

Baby is very much better. He takes his bottle after each nursing and likes it ever so much. He vomits just a little bit, but sleeps through the night now. He is quiet for three hours and seems a different baby.

*Weight.*—Eleven pounds eight ounces, a gain of ten ounces in a week.

*Temperature.*—98° F.

*Examination.*—The child certainly looks better and happier and begins to have the contented look of the normal baby.

**Discussion.**—With such a nice response of the weight we ignore absolutely the vomiting. The baby's general nutrition, which is the point in which we are interested, has certainly improved.

*Directions.*—Mother, keep up this treatment and let's see him again in a week.

### CLINIC V.—BABY 1

*Age.*—Five months one week.

Mother says the baby is doing nicely, but that he is a little hungry; that no sooner does he empty his bottle than he cries for the next one.

*Weight.*—Eleven pounds fifteen ounces, showing a gain of seven ounces during the week.

*Temperature.*—98.6° F.

*Examination.*—Child looks bright and happy.

**Discussion.**—I don't think we can complain of that gain in weight, and I should advise the mother to let him *absolutely alone.* He is gaining really faster than he should.

Mother says: "That is all right, doctor, but I have no breast milk. For the last week my breast milk has gone entirely, and to tell the truth, I have given him more of the bottle myself."

*Directions.*—Well, that's different. We'll put him on regular bottle feedings for a baby of his age. He's over four months old, so we'll order—

| | |
|---|---|
| Milk | 20 ounces |
| Water | 11 ounces |
| Sugar | 6 teaspoonfuls |

Five feedings and start a little cereal.

### CLINIC VIII.—BABY 1

*Age.*—Six months.

Mother says the baby did all right for a week, but for the last two has been hungry and not gaining.

*Weight.*—Twelve pounds eight ounces, showing a gain of nine ounces in three weeks.

*Temperature.*—98.6° F.

*Examination* shows him to be in good condition.

*Directions.*—Mother, baby is now six months old; so you gradually may offer a greater variety of food. Very slowly add a little soup or vegetable or chicken broth. Give an occasional Graham cracker or a little zwieback, which is the same as hard, dry, doubly baked bread. If you can't get it, take some toast and bake it thoroughly until very hard and dry. Give the

zwieback or Graham cracker mashed up with a little broth, or soaked in the soup or the bottle, or baby may like to take it in his hand and chew it. In addition to these, start a variety of cereals, such as farina, corn-starch, Cream of Wheat, or arrowroot.

We can begin with vegetables: you may use almost any that can be boiled to soft consistence, put through a sieve, and made into a purée. This includes mashed potatoes. Perhaps the best at first is spinach or carrots. Carrots are best given if cooked and then grated right into the soup.

Of course, the baby must have fruit-juices, such as orange-juice, prune-juice, and also a little apple-sauce or baked apple. A six-months-old baby may have a strip of bacon. Bacon directly from the shop is a little salty; so it's a good idea to soak it first in water to rid it of this excess, and then broil it rather crisp. You may start, too, with beef-juice.

*Question by Mother.*—How shall I cook the cereal?

*Answer.*—If you are using farina, take a tablespoonful to a cup of water; boil this over the fire for half an hour. As the water boils away, of course, add fresh water. In the last few minutes add about half a cup of milk. You must stir this constantly; if you use a double boiler, you won't need to use so much care, but you must cook it for over four hours. Add a pinch of salt and enough sugar to sweeten slightly. In making corn-starch I would use perhaps a little less than a tablespoonful because the corn-starch thickens easily.

*Question by Mother.*—We don't have farina down here; I never heard of it, but could we use hominy or a little mush instead?

*Answer.*—Yes, those would do exactly as well.

*Question by Mother.*—How about oatmeal?

*Answer.*—Some children take oatmeal very well at six months, but to some it seems rather laxative. Of all cereals, oatmeal seems most likely to ferment and cause diarrhea in children of this age.

*Question by Mother.*—How shall I prepare the beef-juice?

*Answer.*—Cut the beef into tiny cubes, throw them into a hot pan to sear the outside, and then squeeze out the juice. You may give a teaspoonful or more a day.

*Question by Dr. Meadows.*—Would you use fresh or canned vegetables?

*Answer.*—If possible, I would certainly use the fresh. By the way, if you have any trouble in making purée, we have a little apparatus in the hospital at home which is of great value. It's a little grinding mill put up by the Enterprise Manufacturing Co., of Philadelphia, called the "Nixtamal Mill." It's inexpensive, costing only a few dollars, and certainly is very satisfactory. Dr. Abt introduced it into our hospital, trying it as a means for pulverizing casein and curds in the making of albumin milk.

Of course, in starting the baby out don't give him a banquet the very first day. You must use considerable discretion and care. I think I should start out perhaps like this: Tomorrow, after the 10 o'clock bottle, add a half teaspoonful of the farina or corn-starch. This being a new food, may be vomited; don't pay any attention to this vomiting, but repeat the next day. Gradually, day by day, increase the dose, so that by the end of two or three weeks he gets the whole quantity. A few days after giving the cereal start, in addition, one of the other foods, as a little broth or a teaspoonful of vegetable purée after the 2 o'clock bottle. A few days later, having increased the quantity of broth to an ounce or more, try a few crumbs of zwieback broken into the broth. In two or three weeks, when you have learned which foods baby prefers, give him at 2 o'clock a little dinner of broth, zwieback, a little vegetable and beef-juice, or bacon. Then, of course, he won't take so much of his bottle; but remember, it's essential to start gradually and increase *very slowly*. As baby is getting small amounts of food the first few days, he won't gain much, and we must tell mother in advance, so that she won't be discouraged if there isn't a marked gain next week.

*Question by Dr. Brown.*—Don't you think, doctor, this is a pretty full diet for so young a baby?

*Answer.*—I suppose it seems that way; I doubt if you will find it prescribed in many texts. On the other hand, if you will only *try* it as I have outlined, I am sure you will agree with me that it is very successful. I have had many discussions and been forced to overcome many objections, particularly from the

nurses, but I believe you will find that such a diet will be adopted more and more. Certainly the brilliant results we get at home are sufficient evidence in its favor. From my own point of view I believe that our fear of overfeeding babies has carried us to the other extreme, and that many babies of this age really are *underfed.* Of course, I don't mean that you should cram food into a child and stuff him: simply give him what he wants and you will find that upon the four-hour schedule he adjusts his diet to his own needs and practically never overfeeds himself. Of course, you must remember that as he takes more solid food he drinks less of his bottle; so don't force the bottle upon him. And remember that his daily diet shouldn't contain *everything* in this list, but just should be selected from it.

*Question by Mother.*—Can I add an egg?

*Answer.*—No, I should not advise this as yet. It is true that some children, as early as the eighth or ninth month, take a soft-boiled egg and tolerate it well, but it is wiser, with the majority of children, to wait until they are somewhat over a year.

## CLINIC VII.—BABY 1

*Age.*—Six months one week.

Mother says the diet is causing diarrhea. She has given a little spinach, and he likes it very much. He seems happy and sleeps well, but has a diarrhea, with four or five watery stools daily.

*Weight.*—Twelve pounds ten ounces, a gain of two ounces in a week.

*Temperature.*—98.6° F.

*Examination.*—Well, gentlemen, he looks well, doesn't he? Notice he seems happy, contented, smiling, and he kicks and stamps and waves his arms. He's interested in everything about him, so no matter what mother tells us about his bowels, the baby looks all right, and the gain in weight, though slight, proves this. Probably he hasn't eaten enough to cause a greater gain.

**Discussion.**—In many cases diarrheas occurring upon addition of solid food, though attributed to the diet, depend upon absolutely other factors.

*Question.*—Mother, have you been feeding the baby as we told you?

*Answer.*—I started in very slowly and carefully, and he is getting just a little cereal, broth, and yesterday some spinach.

*Question.*—How long have the bowels been loose?

*Answer.*—Three days.

*Question.*—Have you given any medicine?

*Answer.*—Yes. I was afraid he wouldn't digest the cereal very well, and so I gave him three teaspoons of castor oil for the last three days.

**Discussion.**—No more explanations are necessary, gentlemen. The castor oil explains the diarrhea.

A nice illustration of diarrhea occurring upon change of diet is one I saw yesterday. The baby, one year old, was brought for feeding. He had been breast fed until three weeks before. We ordered a soft diet and a milk mixture of—

| | |
|---|---|
| Milk | 20 ounces |
| Water | 11 ounces |

Five feedings.

We told mother to wean him gradually.

On his return mother reported a diarrhea, which she ascribed to the soft diet. Questioning revealed that in trying to wean the baby she had put salt on her nipples to make them distasteful. The baby liked this addition and took to it eagerly; so the ingenious mother added pepper. This combination proved too much, and the diarrhea resulted.

## CLINIC VIII.—BABY 1

*Age.*—Six months two weeks.

Mother says the baby is well in every respect—the bowels move two to four times a day. He likes his vegetables, and is content and happy.

*Weight.*—Thirteen pounds one ounce, a gain of seven ounces in the week.

**Discussion.**—You see, gentlemen, what one accomplishes by judicious use of a soft diet. Let's let him alone.

Mother, you might bring him back in two or three weeks.

### CLINIC I.—BABY 2

Dr. J. D. Williams (Greensboro)

*Age.*—Five weeks.

*History.*—Negative. Mother has no breast milk and comes for feeding advise.

*Temperature.*—98.8° F.

*Weight.*—Seven pounds three ounces.

*Examination.*—Normal baby.

*Directions.*—

| | |
|---|---|
| Milk | 11 ounces |
| Water | 11 ounces |
| Sugar | 4 teaspoonfuls |

Seven feedings.

Don't omit orange-juice.

Let's see the baby next week.

### CLINIC II.—BABY 2

*Age.*—Six weeks.

Mother says the baby is not doing well; that he cries, doesn't want to eat, has colic, and is awfully constipated. The food doesn't agree with him. He doesn't even empty his bottles, and his mouth is very sore and all white.

*Temperature.*—99.4° F.

*Weight.*—Seven pounds four ounces, showing a gain of one ounce in the week.

*Examination.*—Negative, except for white patches all over gums and mucous membrane of the cheeks.

**Discussion.**—Gentlemen, you see the value of our scales. This week the child gained only one ounce—an insufficient gain, of course. Can this be due to an acute disturbance from overfeeding? No, because there is no acute loss in weight—simply failure to gain. There is no diarrhea; indeed, the baby is very constipated. It's more likely that the pain is that of hunger, and that the failure to gain is from insufficient food.

**Diagnosis.**—We diagnose *mild inanition*, and ask, "Why isn't he drinking his full bottle?" Is it because he doesn't like it? Is it because he has bronchitis, or something interfering with his

drinking? Our examination has answered this question at a glance.

*Question.*—Mother, you've been washing out the baby's mouth. What have you used?

*Answer.*—The druggist recommended some silver nitrate to me.

**Discussion.**—See how a little disturbance absolutely independent of food may arise, and lead you, if not careful, to diagnose improper feeding! Here is an excellent illustration of *thrush* and the improper way of treating it. Thrush, you know, is an infection by a fungus. The fungus never attacks an intact mucous membrane, but only one that has been injured. The surest way of predisposing the child to infection is to wash the mouth with any strong solution or with sufficient mechanical violence to cause injury. Remember, the intact mucous membrane is immune. During my experience in the Finkelstein clinic we could tell at a glance from which maternity hospital our patients came. All those who had thrush came from an institution where it was routine to wash the babies' mouths. Those without thrush came from one where the mouths were *let alone.* There is no surer way of inviting thrush than to wash out the mouth *roughly.* Better let it go unwashed.

*Directions.*—Mother, for the next few days let the baby's mouth *absolutely alone.* Once or twice a day saturate a little cotton with half peroxid and half water, and *just touch* the white spots on the gums and cheeks. Don't rub them or scrape them, but touch them as gently as if you were taking up a blot with a piece of blotting-paper. When his mouth is healed and it doesn't hurt to drink, I think he'll take his bottle better. For the next few days, as his mouth is so sore, feed him with a spoon or a medicine-dropper.

## CLINIC III.—BABY 2

*Age.*—Seven weeks.

Mother says the baby is drinking the bottle with renewed vigor, but that he's hungry.

*Weight.*—Seven pounds five ounces, showing a gain of one ounce in a week.

*Temperature.*—98.6° F.

*Examination* shows the mouth in much better condition.

**Discussion.**—As this gain is insufficient, and as the baby now is taking his entire food as offered, the failure to gain must be due to insufficient amount.

*Directions.*—We'll order an increase to—

| | |
|---|---|
| Milk | 13 ounces |
| Water | 12 ounces |
| Sugar | 6 teaspoonfuls |

Seven bottles.

## CLINIC IV.—BABY 2

*Age.*—Eight weeks.

Mother says baby is doing nicely; that he drinks well and seems satisfied. Until yesterday he had been quite constipated, but yesterday his bowels moved three times and she noticed a lot of white, hard curds in the stool. The other day he had a little cold.

*Weight.*—Seven pounds fourteen ounces, showing a gain of nine ounces in the past week.

*Temperature.*—98.8° F.

*Examination.*—Negative, other than coryza.

**Discussion.**—Gentlemen, as he gained nine ounces in the past week, we're not going to worry about the bowel trouble. Undoubtedly it resulted from the coryza, with secondary fermentation in the intestine, but you see for yourselves, from the happy appearance of the child and from the decided gain, his nutrition is in no way affected.

*Question.*—Mother, are you boiling the milk?

*Answer.*—No, doctor, I thought it would be better to give it raw.

*Directions.*—Mother, if you will boil the milk the hard curds will disappear from the stool. Use a little liquid vaselin for the nose, and when the cold is better his bowels will correct themselves. If they don't in a day or two, the doctor will order some chalk mixture.

### CLINIC I.—BABY 3

Dr. C. S. Gilmer (Greensboro)

*Age.*—Seven weeks.

*History.*—Mother lost her milk and has never nursed any of her babies over a few weeks. She comes for advice.

*Temperature.*—98.6° F. Weight, seven pounds fifteen ounces.

*Examination* shows a happy baby. Everything negative.

**Discussion.**—He has been getting—

| | |
|---|---|
| Milk | 14 ounces |
| Water | 14 ounces |
| Sugar | 6 teaspoonfuls |
| Seven feedings. | |

This seems a perfect formula. You notice it's half milk and half water, and approximately 3 percent carbohydrate. The total quantity is a little above the average for babies of this age, but if he's taking it well and not vomiting, I don't believe it needs to be changed.

*Directions.*—Continue this formula. Don't forget to shake the milk thoroughly before making up the mixture, and don't forget the orange-juice.

### CLINIC II.—BABY 3

*Age.*—Eight weeks. The baby is fine, happy, and contented in every way.

*Weight.*—Eight pounds four ounces, showing a gain of five ounces.

*Temperature.*—98.8° F.

*Examination.*—Negative.

*Directions.*—Baby is doing well, but you had better bring him next week.

**Discussion.**—Gentlemen, I like to have the babies return as often as possible. It's the best means to keep a check on them. Those who don't return, puzzle us: may be the diet didn't agree with them. On the other hand, may be it agreed with them so well that the mother thinks her troubles are over—a dangerous conclusion, however. As I have tried to emphasize, any baby upon the bottle is to be regarded as sick, and I urge

you to impress this upon your patients and have them return as frequently as possible.

### CLINIC III.—BABY 3

*Age.*—Nine weeks.

Mother says the baby seems to be doing pretty well but is hungry. He had a croupy cough for the last two or three days. His bowels are constipated, with hard stools.

*Weight.*—Eight pounds two ounces. Loss of two ounces in the week.

*Temperature.*—99.2° F.

*Examination.*—Very slight bronchitis.

*Question.*—Mother, does the baby vomit when he coughs?

*Answer.*—No.

*Question.*—Is his cough worse at night or in the daytime?

*Answer.*—It's worse in the daytime.

*Question.*—Does he whoop at all?

*Answer.*—No.

**Discussion.**—Gentlemen, in all cases of coughing in children, don't overlook pertussis. In this case we're glad to hear that the stool is constipated, although the mother looks shocked. Children, especially the young ones, when they develop coughs or colds, show severe diarrheas and nutritional disturbances. The fact that this child hasn't reacted shows, first, that his intestinal tract is unaffected, and, second, that we needn't fear increasing his diet. Mother says he's hungry and would like more. If, however, he were having a diarrhea associated with this cough, we certainly shouldn't order an increase. The weight shows a loss of two ounces this week, yet the mother says he empties all his bottles. If he were having a diarrhea at this time, we might diagnose a mild dyspepsia. The fact that he's constipated; that he empties all the bottles and still is hungry, makes us believe that his failure to gain is not due to any complication but simply to insufficient food.

*Directions.*—We'll order—

| | |
|---|---|
| Milk | 16 ounces |
| Water | 16 ounces |
| Sugar | 7 teaspoonfuls |

Seven bottles.

I warn you this is rather daring for children suffering with infections, but the fact that he looks and acts perfectly well—notice his rosy color and his pleasant smile—and that he is hungry, warrants, I believe, this increase.

### CLINIC IV.—BABY 3

*Age.*—Ten weeks.

Mother says the baby is in fine condition. His bowels move once a day, sometimes twice.

*Weight.*—Eight pounds nine ounces, showing a gain of seven ounces in the last week.

*Temperature.*—98.6° F.

*Examination.*—Negative.

*Directions.*—As long as he is gaining we'll make no change.

### CLINIC V.—BABY 3

*Age.*—Eleven weeks.

Mother says the baby is in good condition, but thinks he is a little hungry.

*Weight.*—Nine pounds one ounce, showing a gain of eight ounces during the week.

*Temperature.*—98.6° F.

*Examination.*—Negative.

*Directions.*—As the gain is surely normal, better make no change in the feeding, except from seven to five feedings, without altering the total quantity.

### CLINIC VI.—BABY 3

*Age.*—Three months.

Mother says the baby is hungry.

*Weight.*—Nine pounds four ounces, showing gain of only three ounces in the week.

*Temperature.*—98.6° F.

*Examination.*—Negative.

*Directions.*—As he gained only three ounces this week, I think we are justified in ordering a slight increase in diet. He's now three months old. We either may increase the amount and

thus the concentration of the milk exclusively, or we may increase the total quantity, leaving the concentration unchanged. As I like to limit the total to a quart, I'd suggest—

| | |
|---|---|
| Milk | 18 ounces |
| Water | 13 ounces |
| Sugar | 8 teaspoonfuls |

Five bottles.

## CLINIC VII.—BABY 3

*Age.*—Three months one week.

Mother says the child has been crying all the time, that his bowels are "running off" about seven or eight times, with lots of mucus and curds. She thinks the increase in the diet was too much. He has severe colic and is not gaining. He doesn't want the bottle and vomits sometimes.

*Weight.*—Nine pounds four ounces. No gain this week.

*Temperature.*—101° F.

*Examination* reveals nothing except this—notice how pressure on the tragus of the right ear makes him wince and cry.

**Discussion.**—Gentlemen, in 90 percent of cases by this method you can diagnose complications in the auditory canal or the middle ear. Don't attempt to penetrate the cranial cavity, but just exert the mildest sort of pressure. A perfectly normal baby will pay no attention. A baby who is crying, will continue, but will do nothing else. This child, however, not only cries, but winces and jerks his head away sharply. We have, then, either a furuncle in the auditory canal or an otitis media.

*Examination.*—The otoscope reveals an inflamed ear-drum.

*Directions.*—This baby should see the ear doctor. And now we have a dyspepsia and colic, not directly from food, but secondary to otitis media. Shall we change the diet in this case? Not at all, because although there has been a fermentation in the intestinal tract, this fermentation has not been severe enough to interfere markedly with the child's nutrition. He is not losing any weight; so, mother, for the present let the baby alone as regards his diet—let him take what he wishes, feed him regularly, and see an ear doctor. He won't want much for a few days because he has fever; *so don't try to force him.* Use a few drops of a 5 to 10 percent solution of carbolic

acid in glycerin in that ear every three to four hours for a day or two until you see the ear doctor.

Use a few drops of pepsin in a teaspoonful of water for the colic.

### CLINIC VIII.—BABY 3

*Age.*—Three and one-half months.

Mother says the baby seems well. The ear trouble and dyspepsia have disappeared, and he is satisfied and happy.

*Weight.*—Nine pounds nine ounces, showing a gain of five ounces in the week.

*Temperature.*—98.6° F.

*Examination.*—Negative.

*Directions.*—No change.

### CLINIC I.—BABY 4

Dr. D. A. Stanton (High Point)

*Age.*—Eighteen months.

*History.*—Negative, other than that the child has been suffering for six months from repeated attacks of otitis media.

*Temperature.*—98.6° F.

*Weight.*—Twenty-three pounds.

*Physical Examination.*—This shows a pasty, pallid, rachitic child, who looks anemic and water-logged, although there is no edema. There are no adenoids nor large tonsils. Right ear discharging.

**Discussion.**—Gentlemen, I am no ear specialist. However, the child's general nutrition in a way might account for this condition. Of course, in such a child we must rule out tuberculosis, syphilis, hookworm, nephritis, blood diseases, etc. Let's see if the feeding is a factor.

*Question.*—Mother, how have you been feeding the baby?

*Answer.*—I give him mostly milk.

*Question.*—Don't you give him anything else?

*Answer.*—Well, sometimes I give him a little hominy or mush or toast.

*Question.*—Anything else? No vegetables, eggs; anything like that?

*Answer.*—No, that is all he gets; sometimes a few Graham crackers.

**Discussion.**—I think that explains part of the difficulty. The diet of milk and carbohydrate, you remember, is the one causing water-logging of the body, and you remember we spoke of the fact that children such as these seem to have a lessened immunity to disease. I am glad of the opportunity to demonstrate such a case to you, because here we have a disturbance of nutrition not following a parenteral infection, but really predisposing to one.

*Directions.*—Let's refer the child to the ear doctor, but in the meantime get him on a well-regulated diet, and try to increase his general resistance and immunity. Of course, we'll order cod-liver oil with phosphorus.

### CLINIC I.—BABY 5

Dr. A. C. Whitaker (Julian)

*Age.*—Six months two weeks.

*Weight.*—Thirteen pounds one ounce.

*Temperature.*—100.6° F.

*Examination* shows coryza, slight bronchitis, and a mud-colored skin.

*History.*—Negative up to the present. Baby has gotten the breast and a mixture of—

| | |
|---|---|
| Milk | 6 ounces |
| Water | 7 ounces |
| Sugar | 3 teaspoonfuls |

Six bottles.

For two weeks he has had a soft diet. Mother thinks the feedings are not agreeing with the baby, who for the last few days has vomited, had diarrhea, with six or seven stools a day, and refused food. The baby has lost seven ounces during the week.

**Discussion.**—This sounds like a *true dyspepsia*. Of course, the loss of weight could arise from insufficient food, but we question whether a child who has been gaining normally up to the present would, all of a sudden, drop back seven ounces in one week. Vomiting, except in extreme cases, is rarely associated

with underfeeding. Diarrhea may be present in inanition, as well as in other conditions, but from the general symptomatology, the loss of weight, the vomiting, the diarrhea, and the *anorexia*, we diagnose dyspepsia. The cause of the dyspepsia surely can't be the food upon which the child up to the present has been thriving, and we must seek it in other factors.

*Question.*—When did you start the soft diet?

*Answer.*—About a week ago. I gave a little cereal.

*Question.*—How long has he been coughing?

*Answer.*—He got sick about five days ago.

*Question.*—When did the diarrhea start?

*Answer.*—It started three or four days ago.

*Question.*—Are his cough and cold better or worse?

*Answer.*—The cough, I think, is better.

**Discussion.**—Here we have a parenteral infection occurring with the change in diet. The mother blames the diet. We believe, however, that the cough and cold predisposed the child to a mild fermentation in the intestinal tract, and that the reaction was just severe enough to make us careful. In a baby of this age on a soft diet secondary disturbances are not severe. In a study some time ago* we found that the best dietetic treatment for these secondary diarrheas in children on a soft diet is to let them alone and not to vary the diet too dogmatically.

*Directions.*—In this case the doctor will treat the cough and cold as he sees fit, and we'll leave the diet unchanged. Let the baby eat what he wishes. He *won't eat very much* for a few days, and by *no means* force him. To please the mother, let's order a little chalk mixture every three or four hours.

## CLINIC II.—BABY 5

*Age.*—Six months three weeks.

Mother says the baby still has coryza, a bad cough, and *won't eat.* The diarrhea is better, but yesterday he had four rather loose movements.

*Weight.*—Thirteen pounds one ounce. No gain.

*Temperature.*—100.2° F.

*Examination.*—Coryza and bronchitis.

* "Studies on Parenteral Infections," Archives of Pediatrics, 1916, 671.

**Discussion.**—Gentlemen, the child has not gained during this past week. Probably he hasn't eaten as much as usual. The persistency of the bronchitis, with the associated fermentation in the intestine, however, makes us hesitate about urging any forced feedings, particularly as mother says baby is not hungry. Let's wait another week until he gets over this cold.

### CLINIC III.—BABY 5

Baby much better. Cough improved. Appetite returned.
*Weight.*—Thirteen pounds ten ounces. Gain of nine ounces.
*Examination.*—Negative.

### CLINIC I.—BABY 6

Dr. A. F. Fortune (Greensboro)

*Age.*—Seven months.

*History.*—Family history negative. The child was breast fed up to one month, then received malted milk for five months, but didn't do well; was hungry and had diarrhea all the time. Came to the doctor yesterday for advice. He's better now.

*Temperature.*—97.8° F.

*Weight.*—Eleven pounds eight ounces.

*Examination* shows baby only fairly nourished, with inelastic, mud-colored, thin skin which wrinkles easily, and flaccid musculature.

**Discussion.**—As the doctor has ruled out tuberculosis and is positive there is no trace of lues in the family, and as an examination has ruled out anything of a constitutional nature, the findings, with this history of improper feeding, establish the diagnosis of *mild decomposition* of the alimentary type.

*Directions.*—Just to contrast different methods of treatment, let's order a simple milk mixture and omit temporarily the soft diet. Mother give the baby—

| | |
|---|---|
| Milk | 20 ounces |
| Water | 11 ounces |
| Sugar | 3 teaspoonfuls |

Boil this, divide it into five bottles of six ounces each, feed the

baby regularly once every four hours, and be sure to return next week.

**Discussion.**—Gentlemen, personally for all children over six months of age I prefer a soft diet, but I'll order this milk mixture so that you may compare the result here with those of Baby 1.

### CLINIC V.—BABY 6

*Age.*—Eight months.

Mother says she didn't bring the baby back before because he gained so well for a few weeks she thought it wasn't necessary. For the last few days his bowels moved five or six times a day, he has vomited, and looks very puny again. No blood in the stools.

*Weight.*—Ten pounds, showing a loss of one and one-half pounds in four weeks.

*Temperature.*—97.2° F.

*Examination.*—Negative as to causes other than feeding.

**Discussion.**—The reason for this loss in weight easily is explained. You know the great importance of carbohydrate. We withdrew sugar for just a few days, intending to supplement it with cereals, zwieback, and other non-fermentable carbohydrates. However, mother didn't bring baby back, and now for four weeks, due to lack of carbohydrate, and of course to other food elements, too, he has been developing a severe decomposition.

The onset of the diarrhea a few days ago shows the beginning intolerance to food, and he now is in worse condition than when we first saw him.

*Directions.*—We'll put him then on regulation treatment for decomposition. We'll reduce the concentration of the milk to about half—

| | |
|---|---|
| Milk | 15 ounces |
| Water | 15 ounces |
| Five bottles. | |

We'll add non-fermentable carbohydrate to the mixture, approximately four teaspoonfuls of dextri-maltose, and to sweeten a little, I think it safe to add one or two teaspoonfuls of sugar. We'll give four ounces every three hours, and very care-

fully start zwieback and cereal once or twice a day. We may also offer carbohydrate in the form of a little mashed potato. Return in a week.

*Question by Dr. Woodson.*—Did I understand you to say mashed potatoes for a baby of seven months in this condition?

*Answer.*—Yes, if *very thoroughly* cooked and mashed and given in *small* doses this is a convenient way of giving non-fermentable carbohydrate.

**Discussion.**—This was the child in whom we treated the condition of decomposition by an ordinary milk mixture instead of a soft diet. If the mother had returned, as she should have, the result would certainly not have been so unsatisfactory. Don't think that one will accomplish such poor results by the exclusive use of mik mixtures, but at any rate, on a soft diet, such an unfortunate occurrence could not have happened, for the child's demand for carbohydrate would have been covered by the cereals, potatoes, zwieback, and Graham crackers.

### CLINIC VI.—BABY 6

*Age.*—Eight months one week.

Mother says the child is much improved; he is eating zwieback and cereal, and she is keeping the milk formula as directed. Bowels move two or three times daily and are almost normal.

*Weight.*—Eleven pounds four ounces, representing a gain of *one pound four ounces* in a week.

*Temperature.*—98.4° F.

*Examination.*—Child better and brighter.

*Directions.*—No change in feeding is necessary.

### CLINIC VIII.—BABY 6

*Age.*—Eight months three weeks.

Mother says the baby is doing nicely.

*Weight.*—Twelve pounds, showing a gain of twelve ounces in two weeks.

*Temperature.*—98.6° F.

*Examination.*—Doing nicely.

*Directions.*—No change.

## CLINIC I.—BABY 7

Dr. Thomas Anderson (Statesville)

*Age.*—Eight and one-half months.

*History* tells us he is a premature, weighing three pounds at birth. After a few months of breast feeding mother lost her milk and gave—

| | |
|---|---|
| Milk | 10 ounces |
| Water | 12 ounces |
| Sugar | 6 teaspoonfuls |

Seven bottles.

He is hungry and suffers frequently from diarrhea.

*Temperature.*—97.6° F.

*Weight.*—Six pounds twelve ounces.

*Examination.*—Having ruled out tuberculosis and syphilis, examination shows nothing more than an extremely rachitic, anemic, undernourished child in a state of decomposition.

*Directions.*—You see the importance of a careful history. The fact that he is decidedly premature makes us very careful indeed, particularly as he is also in a state of decomposition. Let us wait a week and see what he is doing, except let's use dextri-maltose instead of sugar.

## CLINIC II.—BABY 7

*Age.*—Eight months three weeks.

Mother says the baby shows no change—that he still frets considerably. Bowels move three times a day.

*Weight.*—Six pounds twelve ounces, showing no gain.

*Temperature.*—97.6° F.

*Examination.*—No change.

*Directions.*—Increase very carefully to—

| | |
|---|---|
| Milk | 14 ounces |
| Water | 12 ounces |
| Dextri-maltose | 6 teaspoonfuls |

Seven bottles.

**Discussion.**—In feeding prematures there are a few points to be considered: First, remember that in every case you should suspect lues—not that you will find it, but you always must consider it.

Next, if you are working with calories, prematures need more than do normal babies. Dr. Julius H. Hess, of our city, made a nice study recently, showing this higher requirement. This is easily understood, for the premature must gain not only as does a normal baby, but must make up back losses.

An interesting point in feeding is brought out by Langstein. Up to this time the mortality of his prematures was very high. In many instances, when put to the breast, due to their great weakness, they tired before getting sufficient food, and from the resulting inanition, developed decomposition and death. Langstein found that, by forcing feedings either with a medicine-dropper or a stomach-tube, by getting more food into them, the mortality was greatly reduced. Gentlemen, if your premature on the breast isn't gaining, don't waste time. Put him to the breast more frequently. If he still doesn't gain, force more food into him, either with a medicine-dropper or, if that fails, with a stomach-tube. In this baby we won't waste any time, but as his curve shows no gain, we increase at once.

A valuable point is the following: Often the amount of breast milk necessary, overloads the stomach, causes vomiting, and defeats our purpose. This we readily may obviate by offering small quantities of buttermilk mixture—a mixture of boiled buttermilk with 5 percent dextri-maltose. This is food of high concentration, and is indicated particularly in prematures, who seem to need especially protein and salts. However, remember that this combination is one of concentrated whey with carbohydrate, and is likely to induce intestinal fermentation and nutritional disturbances; so under no circumstances offer more than one-third or one-half of the total amount of breast milk given.

Clinical observation has taught that prematures and many twins develop, almost invariably, during the third or fourth month, severe anemias and bad rickets. It was Czerny who first offered an explanation. Just consider for a moment the composition of breast milk. In one quart there is $\frac{1}{60}$ grain of iron and little over 7 grains of calcium. There is insufficient iron, barely enough calcium, to cover the needs of the child. Czerny suggested that during the last three months of intra-uterine life storage-warehouses of iron develop in the body.

The main one seems to be in the liver. During the first months of life, while baby is on the breast, he doesn't live on the iron of breast milk but upon that in the body. In a like manner, Czerny suggested calcium warehouses, although the latter are not quite so well established as the former. Now you see, gentlemen, why prematures develop anemia and rickets. They have come into the world before these deposits have been developed, and the supply of iron and calcium in breast milk is insufficient for their needs. In a like way, twins suffer because they have to share their supply with each other.

It is a good idea, as a prophylactic, in all cases of twins and prematures, to add, after the first few months, a little calcium, some cod-liver oil, and often some iron. If you practise these methods of prophylaxis, you will be gratified with your success. Severe anemias rarely develop, and rickets appears only in its milder forms.

The same conditions exactly develop in those children fed too long on the breast. Don't think for a minute that breast milk is the ideal food for a baby over six to nine months of age. There is nothing wrong with breast milk, but it doesn't supply sufficiently, the ingredients necessary. Of course, some children cover their demands by taking a larger quantity of milk from the breast, particularly if the mother has an abundant supply, but you'll find that most normal children, if kept exclusively on the breast after nine months of age, will develop anemias and rickets, just as do prematures and twins.

From these studies of physiology, you will understand why I have always insisted upon a mixed diet for every child of six months of age. The purpose is to provide for these known deficiencies, and also for some of those, perhaps, whose existence, though now unknown, may be revealed in future observation and experiment.

In regard to calcium, how we give it is unimportant, provided we give it in the form the baby likes. I should suggest a mixture of

Calcium lactate.......................... 1½ drams
Syrup of orange, to make.................. 4 ounces
Two teaspoonfuls three times a day.

This gives about six grains of calcium three times daily.

The addition of cod-liver oil can be as follows:

Ol. morrhuæ.................................℥viij
Ol. phosph..................................ʒj
Sig.—Teaspoonful thrice daily after meals.

As each teaspoonful contains one drop of oil of phosphorus, and as one drop of oil of phosphorus contains $\frac{1}{100}$ grain of phosphorus, a teaspoonful of this mixture contains $\frac{1}{100}$ grain of phosphorus. You also may use mixtures of cod-liver oil and malt.

These mixtures aren't delicious, but if you persist, children take them well. As they sometimes impair the appetite, it is a good idea to give them after the feeding. On the other hand, if baby vomits, give before the feeding. Then, if the baby vomits, it makes no difference. Don't pay any attention to the vomiting, but keep up the treatment, and the majority of children learn to take it readily. In some cases it may be wise to start with 10 to 15 drops and slowly increase to a teaspoonful.

### CLINIC III.—BABY 7

*Age.*—Nine months.

Mother says child is still hungry.

*Weight.*—Seven pounds, showing a gain of four ounces during the week.

*Temperature.*—98° F.

*Examination.*—No change. Still peevish.

*Directions.*—

Milk..............................18 ounces
Water.............................10 ounces
Dextri-maltose.................... 8 teaspoonfuls
Seven bottles.

Continue calcium and cod-liver oil.

### CLINIC VI.—BABY 7

*Age.*—Nine months three weeks.

Mother says baby is much better.

*Weight.*—Eight pounds four ounces, showing a gain of one pound four ounces in three weeks.

*Temperature.*—98.8° F.

*Examination.*—Child better.

### CLINIC VII.—BABY 7

*Weight.*—Eight pounds twelve ounces, showing a gain of 8 ounces during the week.

Better.

### CLINIC VIII.—BABY 7

*Weight.*—Nine pounds, showing a gain of 4 ounces during the week.

*Directions.*—Give a little cereal and continue calcium and cod-liver oil. Slowly start a soft diet.

*Examination.*—A fine baby. No signs of rickets other than a slight rosary.

### CLINIC I.—BABY 8

Dr. S. F. Pfohl (Winston-Salem)

*Age.*—Four and one-half months.

*History.*—Family and past history are negative, except that during the first two days of life the child had fourteen hemorrhages from the bowels. These stopped upon injections of horse-serum. Since then he has been on the breast, but is gaining slowly and is very pale. Mother now has no milk and is giving—

| | |
|---|---|
| Milk | 10 ounces |
| Water | 9 ounces |
| Sugar | 5 teaspoonfuls |

Six bottles.

He is not gaining on this and is very constipated.

*Temperature.*—97.6° F.

*Weight.*—Seven pounds three ounces.

*Examination.*—Rachitic baby of the decomposition type, with extreme pallor.

**Discussion.**—Gentlemen, here is an example illustrating in another way the points of the previous case. This child suffered at birth a great loss of iron from his system, and the feedings since are insufficient to make up this great loss.

*Directions.*—We'll increase his food slightly:

| | |
|---|---|
| Milk | 14 ounces |
| Water | 8 ounces |
| Sugar | 6 teaspoonfuls |

Six bottles.

We also will offer iron, as we would to prematures and twins; here, however, not as a prophylactic, but as actual treatment. The most convenient form is the saccharated carbonate. The ordinary dose is three to four grains, but for practical purposes it is sufficient to tell the mother to take as much as she can put on the end of an ordinary knife. Give this to the baby in a teaspoonful of water about three times a day. Children take it well.

### CLINIC II.—BABY 8

*Age.*—Four months three weeks.

Mother says the baby is much better, but she is dissatisfied with the stools, which are green, watery, and contain curds. Three movements a day. The baby himself is happier and more contented.

*Weight.*—Seven pounds ten ounces, representing a gain of seven ounces in a week.

*Temperature.*—98° F.

*Examination.*—Color hasn't changed much.

*Directions.*—As we are more interested in *the baby* than in the stools, and as he has gained more than we anticipated, we'll *let him alone.* Forget about the stools, and feed him just as you are doing. Return in a week. Continue the iron.

### CLINIC III.—BABY 8

*Age.*—Five months.

Mother says baby is better and brighter in every way. Stools are normal.

*Weight.*—Seven pounds fourteen ounces. Gain of four ounces in a week.

*Temperature.*—98.2° F.

*Examination.*—No change except a bit of color in baby's cheeks.

### CLINIC IV.—BABY 8

Baby improving nicely. Is now hungry again and constipated.

*Weight.*—Eight pounds one ounce. Gain, three ounces in the week. This is not sufficient and is an indication for more food.

*Temperature.*—98° F.

*Examination.*—Child looks fresher. More color to cheeks.

*Directions.*—Continue iron. Increase diet to—

| | |
|---|---|
| Milk | 16 ounces |
| Water | 9 ounces |
| Sugar | 7 teaspoonfuls |

Six bottles.

## CLINIC I.—BABY 9

Dr. R. E. L. Flippen (Pilot Mountain)

*Age.*—Four months.

*History.*—Family and past history negative. As regards feeding: He received condensed milk during the first two and one-half months. The mother couldn't nurse him, and at that time he suffered severe dysentery, with sixteen stools a day. These showed blood infrequently. For the most part they were thin and watery, with mucus—probably not of the infectious type.

From then until the present the child got Mellin's Food and barley water. He doesn't seem doing well, cries incessantly, and apparently the food is not agreeing with him. He is suffering from no cough, fever, or other disturbance. The only symptoms seem to be indigestion, occasional vomiting, and frequent attacks of diarrhea. At present stools are about four to six a day—green, watery, with mucus and curds.

*Temperature.*—98° F.

*Weight.*—Ten pounds nine ounces.

*Examination.*—Almost the first glance tells us that he belongs to the disturbances of nutrition. You notice the flabby, inelastic skin, its peculiar muddy color particularly about the eyes and cheeks, and the bluish rings around the eyes. The sore buttocks suggest acid stools. Notice how he puts his fist in his mouth. He doesn't cry, but he doesn't look happy. Notice the tenseness and rigidity of the muscles. This occurs often in children on one-sided carbohydrate diets. Of course, we must not jump to such a conclusion without ruling out diseases, as meningitis or birth paralyses, but examination, excepting for a few cervical glands of pea size, is absolutely negative.

*Diagnosis.*—We have here a *mild decomposition*. This child, however, is also in a condition of *dyspepsia*, and I am glad he

came today, because he illustrates nicely the subject of the lecture.

*Treatment.*—Mother, in order to give his stomach and intestines a rest, for the remainder of the day give him absolutely nothing but a little weak tea. You may sweeten it with a pinch of sugar, but just enough to sweeten it slightly.

*Question by Mother.*—How shall I give it?

*Answer.*—At his regular feeding hours, 6, 10, 2, 6, and 10 o'clock. Give him as much as he wants at these times, and nothing whatsoever between meals.

*Question by Mother.*—What kind of tea shall I give?

*Answer.*—Any tea at all that you use at home, green or black, provided you make it weak. Tomorrow start with a mixture of one-third milk:

| | |
|---|---|
| Milk | 10 ounces |
| Water | 20 ounces |
| Sugar | 3 teaspoonfuls |
| Five feedings. | |

Keep him on this for two days, and then push him up gradually by the end of the week to—

| | |
|---|---|
| Milk | 15 ounces |
| Water | 16 ounces |
| Sugar | 5 teaspoonfuls |
| Five feedings. | |

The doctor will see you during the week.

*To Doctor.*—You see, we started the baby on one-third milk, and ordered the mother to increase it in a few days. I think it would be a good idea to run in and judge how the baby is doing before the mother makes this increase. Let your index, to the best of your ability, be the weight curve, and if the baby ceases losing weight and seems better, make the increase. On the other hand, if he should lose rapidly and the diarrhea continue, better wait for a day or two. If you have no access to scales, perhaps it would be wiser to go by the *number* of stools in this case, and not increase unless the stools have decreased to approximately three or four a day. In all our treatment we are influenced far more by the *number* of the stools than by the appearance of the individual stool.

### CLINIC II.—BABY 9

*Age.*—Four months one week.

Mother says the baby is better and happier in every way. He is very, very hungry and not satisfied with the bottle—he wants more—he can't wait four hours; indeed, she gives him a little in between. The stools have diminished to three daily.

*Weight.*—Eleven pounds one ounce, showing a gain of eight ounces.

*Temperature.*—98° F.

*Examination.*—Child looks fresher.

**Discussion.**—Gentlemen, we are far happier with the gain in weight than we are with the diminished stools, although, of course, both are very gratifying to us. We now have the child in such condition that his general nutrition is improving.

*Directions.*—I think, in such a condition, we can pay heed to the appeal of the mother and the baby and order an increase, as his present diet is, of course, insufficient. We'll do this very carefully; but as the baby is gaining and happier in every way, I think we're justified. Let's increase to—

| | |
|---|---|
| Milk | 18 ounces |
| Water | 13 ounces |
| Sugar | 6 teaspoonfuls |
| Five bottles. | |

I risk this, gentlemen, because the baby is over four months of age, and the older the child, of course, the less susceptible, but you notice we keep the concentration of milk still not much over one-half.

### CLINIC III.—BABY 9

*Age.*—Four months two weeks.

Mother says the baby is much improved. The stools vary from three to four a day. He is hungry.

*Weight.*—Eleven pounds four ounces, showing a gain of three ounces in one week.

*Temperature.*—98.2° F.

*Examination.*—As before.

*Directions.*—As he cries considerably; as the scales show in-

sufficient gain and the intestinal tract is in better condition, we increase to—

| | |
|---|---|
| Milk | 20 ounces |
| Water | 11 ounces |
| Sugar | 6 teaspoonfuls |
| Dextri-maltose | 3 teaspoonfuls |
| Five bottles. | |

We add dextri-maltose, as it is not so sweet as cane-sugar and because it is less fermentable.

### CLINIC V.—BABY 9

*Age.*—Five months.

Mother says the baby is doing nicely, but for the last week he has been crying considerably. He doesn't vomit; has no colic; but just cries all the time. He has no cough, fever, diarrhea. He stops crying if she picks him up.

*Weight.*—Twelve pounds one ounce, showing a gain of thirteen ounces in the last two weeks.

*Temperature.*—98.8° F.

*Examination.*—As regards temperature, foci of infection, otitis, pharyngitis, and urinalysis, negative.

**Discussion.**—Gentlemen, we have here a baby who seems to cry all the time. Organically there is nothing wrong. Can it be the cry of hunger? No, for the child has gained thirteen ounces in two weeks. Can it be the cry of indigestion or overfeeding? No, for there has been no vomiting and the stools have been normal. The crying is not related to meals. We are tempted to believe the following: He is an only child. Experience has taught that the mother of an only child usually is an exceedingly nervous individual. She fusses continually, carries him more than he should be carried, and often excites him. Is that true, mother?

*Mrs. Jones* (*nurse*) states: I guess we'll have to admit that—the mother is really very anxious, and certainly the baby has stopped crying whenever she picks him up.

**Discussion.**—Gentlemen, listen to that crying. It is not that of pain; it is characteristically that of temper. See the value of the weight curve! It is a greater guide to us even than baby's

disposition, though of course the latter is of value also. If we were guided in our feeding mainly by the child's temperament, we should have changed the diet in this case. Mother, pick up the baby and show us how to cure him.

*Treatment.*—Mother instructed not to worry about the baby's crying; told that the cry is one of temper, and urged to let him cry to his heart's content for a few days.

### CLINIC VII.—BABY 9

*Age.*—Five months two weeks.

Mother says the baby is better. He cries much less, but she finds it difficult to restrain herself from picking him up.

*Weight.*—Twelve pounds fifteen ounces, showing a gain of fourteen ounces in two weeks.

*Temperature.*—98.8° F.

*Examination.*—Negative.

*Directions.*—No change.

### CLINIC I.—BABY 10

Dr. F. Raymond Taylor (High Point)

*Age.*—Four months.

*History.*—Negative, other than that he is a condensed milk baby; but since taken to Dr. Taylor last week he has received half milk and half water, with 3 percent dextri-maltose, a total of 24 ounces a day. Previously he had considerable diarrhea, but now his stools seem normal. He's much better, and the mother says there is nothing acute the matter with him—simply he isn't thriving.

*Temperature.*—97.6° F.

*Weight.*—Nine pounds.

*Examination.*—A pale, flabby child. Notice the emaciation. Peristalsis can be seen through the abdominal wall. See how he puts his fingers into his mouth! However, we have one good sign here. Although he's a puny little fellow, he smiles. Here again, as long as we have ruled out tuberculosis, syphilis, nephritis, and cystitis, and as physical examination is absolutely negative, particularly as the history is one of improper feeding, this child belongs to the group described as *decomposition.*

*Question.*—Mother, is he hungry?

*Answer.*—Yes, he certainly would take more.

*Directions.*—Well, let us give him a little larger quantity. Remember, though, it is wiser to offer a mixture not so concentrated as for a normal child. Understand, gentlemen, for such children the ideal mixture is albumin milk, but as we can't obtain it, we have to use an ordinary milk mixture. This is much less efficient. Let us order:

| | |
|---|---|
| Milk | 15 ounces |
| Water | 16 ounces |
| Dextri-maltose | 8 teaspoonfuls |
| Seven bottles. | |

### CLINIC II.—BABY 10

*Age.*—Four months one week. (Does not return to Clinic.)

The nurse says the baby is gaining satisfactorily according to an outside scales, and his stools are normal, but he seems hungry, and asks if she may increase the diet.

*Weight.*—Not obtained.

*Temperature.*—Not obtained.

**Discussion.**—Gentlemen, whenever a baby is gaining it is unwise to increase, especially in these cases of marked decomposition, if you cannot see the baby personally.

*Directions.*—I don't believe I'd make any change, except possibly a slight increase in carbohydrate. As the stools are normal, we might give nine teaspoonfuls of dextri-maltose instead of eight. But let us keep the concentration of the milk unchanged. As he's better, we might ease the mother's work by ordering five feedings, but *under no circumstances* change the total quantity in twenty-four hours. This means the baby will get five feedings of approximately six ounces each.

### CLINIC IV.—BABY 10

*Age.*—Four months three weeks.

Mother says the baby is very sick. He's had "running off" of the bowels, seven or eight movements a day, and has been vomiting a lot. She is sure he lost weight. His food for the past three days is not agreeing with him at all, and she wishes something else.

*Weight.*—Eight pounds fourteen ounces, showing a considerable loss, for the child weighed nine pounds three weeks ago, and had been gaining considerably.

*Temperature.*—97° F.

*Examination.*—One glance shows a severe nutritional disturbance. The skin, which three weeks ago showed returning elasticity, fulness, and color, again is inelastic and wrinkly. The child has shrunken in every way. There are circles under the eyes. The smile is no longer present. He appears anxious and miserable. The cheeks are sunken, and generalized rigidity is marked. There is no coryza, no bronchitis, no tenderness over the ears, no redness in the throat. There is no evidence of parenteral infection. Here we have a *decomposition* baby in the state of *dyspepsia*, almost verging on *intoxication.*

**Discussion.**—Mother says the food is not agreeing with him. This statement I am not prepared to admit, for a food upon which a child is thriving will not all of a sudden become injurious without the introduction of some other factor. Here our scales are a check, and they told us definitely that up to a few days ago baby had been gaining. We must seek some other factor, because the very slight change in the diet we made two weeks ago would not have had such a marked effect and certainly not ten or eleven days after it had been ordered. Indeed, we ordered a slight change only, feeling we wouldn't be justified in anything more radical without seeing the baby.

*Question.*—Mother, has he coughed or sneezed or had a cold, or has he been putting his hands to his ears during the last week before his trouble started?

*Answer.*—No, I haven't noticed that. He coughed once or twice and he cried a lot.

*Question.*—Did he cry before or after the trouble started?

*Answer.*—He cried after.

**Discussion.**—Gentlemen, we are strongly tempted to lay the blame to this little cough, but I don't think we are justified. It was too mild. Still I don't want to censure the milk mixture. What other outside factors might be important?

*Question.*—The weather hasn't changed much. Are you dressing the baby any differently than you did?

*Answer.*—No, during these hot days he wears just his shirt and diaper.

**Discussion.**—Heat retention, then, can't be a factor. Possibly the mother has misunderstood instructions. Let's see if she is following the technic of feeding accurately.

*Question.*—Mother, tell us exactly how you are feeding the baby.

*Answer.*—Well, I did just as you told me. I increased the food, and gave him six ounces in each bottle as I was directed.

That is just what we ordered.

*Question.*—How often did you give it?

*Answer.*—Every three hours.

*Question.*—How often?

*Answer.*—Every three hours.

**Discussion.**—Well, there's the trouble. You remember, gentlemen, last week we changed to the four-hour schedule so as to make it easier for the mother. We increased the amount to six ounces in each bottle, but we *did not* increase the total quantity in twenty-four hours. Mother has been feeding six ounces every three hours, which means a total of forty-two ounces of food, and we ordered only thirty ounces. So we have a severe dyspepsia developing from *overfeeding* in a decomposition baby. There is nothing wrong with the food itself. The trouble was *too much food.* Now we must treat a decomposition baby plus a case of severe dyspepsia. I wish we had albumin milk. We give nothing but tea until tonight; then one-third milk, as—

| | |
|---|---|
| Milk | 10 ounces |
| Water | 20 ounces |
| Dextri-maltose | 4 teaspoonfuls |

Divide this into seven bottles of four ounces each.

*Now, mother, don't give over four ounces at a feeding.*

In a day or two we shall increase the concentration, so that by four or five days he'll get—

| | |
|---|---|
| Milk | 15 ounces |
| Water | 15 ounces |
| Dextri-maltose | 6 teaspoonfuls |

Seven feedings.

Remember this means *four ounces* every three hours for *seven feedings* in a day.

*Question by Mother.*—In a day do you mean day and night?

*Answer.*—Seven feedings in twenty-four hours.

### CLINIC V.—BABY 10

*Age.*—Five months.

Mother is dissatisfied; she says the baby is better, but still vomits. Stools are three or four daily.

*Weight.*—Nine pounds one ounce, showing a gain of three ounces in the week.

*Temperature.*—98° F.

*Examination.*—Absolutely no change.

**Discussion.**—The child has gained three ounces this week. The bowel movements have improved; the child looks better. The fact that the *weight curve is rising* proves that this gastric disturbance is not affecting his nutrition. As we get no history of parenteral infection, and as our examination is negative, we ask again, "can it be possible that the mother still is not following directions?"

*Question.*—Mother, tell us exactly how you are feeding the baby.

*Answer.*—I make double the amount you told me.

*Question.*—How much did we tell you?

*Answer.*—Milk, 15 ounces; water, 15 ounces; dextri-maltose, 6 teaspoonfuls, in seven feedings of four ounces.

*Question.*—That's right; but why twice the amount?

*Answer.*—I've got two babies at home, and so it is easier.

*Question.*—Has this child been satisfied with four ounces?

*Answer.*—No, he wants more.

*Question.*—Don't you sometimes give him a little of his brother's bottle, mother?

*Answer.*—Well, sometimes I do.

*Question.*—How much?

*Answer.*—For the last few days I gave him five ounces?

**Discussion.**—Gentlemen, here you have the same trouble over again. Last week we treated this dyspepsia by food withdrawal, and then, as the child was in a state of decomposition,

we were particularly careful about increasing. The baby evidently improved on this treatment, for he gained weight. Now, however, mother is pushing the quantity too rapidly, and this vomiting is a symptom of another *beginning* overfeeding dyspepsia. In this case it is unnecessary to withdraw food entirely because the *baby is gaining.* I think if we limit the amount and lessen it just sufficiently to stop the vomiting, the result will be satisfactory.

*So, mother, if you want the baby to get well* you simply must follow our instructions. We told you to give seven feedings of four ounces, and no matter how much he cries, *under no circumstances give him any more.*

Come next week.

### CLINIC VI.—BABY 10

*Age.*—Five months one week.

Mother says the child still vomits, but somewhat less than last week. For three days he's had diarrhea, with seven or eight watery stools a day, cries, and has colic.

*Weight.*—Nine pounds, showing a loss of one ounce in the week.

*Temperature.*—99.4° F.

*Examination.*—Coryza.

**Discussion.**—The weight curve has remained almost horizontal. The stools show intestinal fermentation. So here we have a mild dyspepsia.

*Question.*—Mother, how long has the baby had this cold?

*Answer.*—For four days. His nose runs all the time.

*Question.*—Did he have fever?

*Answer.*—Yes, I think he had a little fever.

*Question.*—Is he better now?

*Answer.*—Yes, he's some better.

**Discussion.**—Gentlemen, the history here is typical, *i. e.*, a decomposition baby, susceptible as he is to every external influence,—to heat, to cold, to infections,—being attacked with a slight coryza. One day later he reacts with diarrhea. Such children are usually very sick and develop severe nutritional disturbances. Here, however, our weight curve makes a relatively good prognosis. The very slight drop shows us that we

have a milder disturbance, only a dyspepsia, and not a severe form of that. A loss of one ounce in a few days is of no grave significance.

In such a case, two courses are open. If we could see the patient every day, we might leave the milk as it is, or even increase it slightly, and at the same time withdraw the carbohydrate. This would give us high protein and low sugar in the intestinal tract, *i. e.*, factors favoring putrefaction and overcoming fermentation. The stools would become constipated, but the child would react with a considerable loss of weight, for his tissues would feel the loss of the carbohydrate. The same result could be accomplished with the use of buttermilk. Then, in a day or two, we'd carefully and gradually increase the sugar to answer the tissue requirements. In this case, however, cooperation in the home is none of the best. We may not see the child for two weeks. Total withdrawal of sugar for so long would probably be fatal; and again an injudicious and too rapid increase, with some fermentation already present in the intestine, might produce an *intoxication.* I think the alternative, though apparently somewhat reckless, will be safer in this instance. Let's take into consideration that we may not see this patient for some days, and by that time his body tissues will need, roughly, three percent carbohydrate. Let's avoid the possibility of any error in the home and so order that much at once. From this amount, however, some intestinal fermentation will doubtless arise, and so we'll try to provide for it by ordering putrefactive, alkali-forming reagents, in the hope of preventing intestinal damage. Let us add to the above mixture, curds of one pint of milk, ground very thoroughly through a sieve; in addition, a few teaspoonfuls of chalk mixture every few hours, and I believe with these *alkali-forming* agents we may increase the dextri-maltose to eight teaspoonfuls, thus attempting to give the body tissues the carbohydrate which they need. *This child is on the border line, however.* If at all possible, the doctor should see him every few days, and any evidence of a *further drop* in the weight curve must be taken as diagnostic of a *severer dyspepsia,* and typical treatment instituted.

### CLINIC VII.—BABY 10

*Age.*—Five and one-half months.

Mother says the baby is much improved. Bowels three a day and still loose, but he seems happy and much more content.

*Weight.*—Nine pounds six ounces, showing a gain of six ounces in the week.

*Temperature.*—98.8° F.

*Examination.*—Looks better.

*Directions.*—No change. In a short time we'll add cereals.

### CLINIC I.—BABY 11

Dr. J. H. Boyles (Greensboro)

*Age.*—Nineteen months.

*History.*—Family and past history are negative. He's been a bottle baby since two months of age, when mother lost her milk. Eagle Brand Condensed Milk was given, and he did well for some time. For several months he has received cow's milk and Graham crackers, potatoes, and soup. For some time he hasn't been doing well. He's not thriving; has frequent indigestion, and is very puny. The mother brought him three days ago because of severe diarrhea; with 15 to 20 watery stools a day. There was no blood in these stools; they were green, smelled sour, had mucus and curds. He was feverish, seemed losing weight, vomited considerably, and lay in a stupor most of the time. He was very sick.

The doctor ruled out all constitutional disease, parenteral infections, tuberculosis, and syphilis. Due to the long history of improper feeding and the absence of blood and pus in the stools, he thought definite enteral infection unlikely. Urinalysis was negative, and he made the diagnosis of *alimentary intoxication complicating a condition of decomposition.*

*Examination.*—This shows a child in a miserable state of nutrition; feeble, peevish, and irritable. The skin is dry, wrinkled, and thin. The musculature is atrophied and rather rigid.

*Weight.*—Sixteen pounds six ounces.

*Temperature.*—98° F.

**Discussion.**—Gentlemen, although diarrheas in children of this age more frequently are due to watermelon, raw sweet potatoes, peanuts, anything the child may lay hands on, I think the diagnosis in this instance is absolutely correct. Here is a history of decidedly improper feeding, leading to decomposition. The primary gain on condensed milk was due, of course, to the sugar, and additional feeding of Graham crackers and potatoes furnished still more carbohydrate. There has been nothing to cover the child's demand for protein, for salts, possibly for fat. Soups, you know, have no food value other than the salts they contain.

*Question by Dr. Beal.*—Do you mean to say that soups are not nourishing?

*Answer.*—The ordinary soup which we offer has no food value; it contains simply the extractives of the meat and leaves the nourishing part behind. We feed soups to supply salts and to stimulate the appetite. Children like them, but as regards food value, they are unimportant.

The treatment the doctor ordered in this case seems absolutely perfect. He ordered tea for twenty-four hours. Following this, in the absence of albumin milk, and because a child of this age, and even as sick as this child was, unquestionably can tolerate mixtures of cow's milk, the doctor ordered a mixture of—

| | |
|---|---|
| Milk............................. | 15 ounces |
| Water............................ | 15 ounces |
| Dextri-maltose...................... | 6 teaspoonfuls |

On this treatment the child is better and happier and the diarrhea has improved greatly.

But, gentlemen, notice how he keeps his hands in his mouth; notice his puny size, his thin, flabby, inelastic skin. Notice the extreme emaciation and *rigidity* of the muscles characteristic of these children on one-sided carbohydrate diets (this is a typical picture of Czerny's starch injury). See how the emaciation reveals general adenopathy, as in tuberculosis! The rigidity is so marked as to make us think of Little's disease. These conditions the doctor has ruled out, and the *weight of sixteen pounds six ounces* shows the miserable state of nutrition, and confirms our diagnosis of *decomposition.* Here, then, we have

a child in the state of decomposition who, for some unknown reason, developed an intoxication. This complication has been successfully treated, and now it is up to us to correct the state of decomposition. As the acute disturbance is past, let us give more food.

*Directions.*—We'll keep the milk in dilute concentration. Then we safely can give more carbohydrate in a non-fermentable form: as farina, corn-starch, arrow-root, mush, tapioca, or Cream of Wheat. We may give a little mashed potato. I think I'd omit oatmeal, which is the most easily fermentable cereal. To supply salts we add vegetable purées. To supply protein, and in this case also to keep the intestine alkaline, we add pure cottage cheese, or, if this is not obtainable, simply the curds of milk. In a baby of this age we may offer finely scraped meat, such as a chicken or lamb-chop. We may add custard and zwieback. I think I would feed this child a little oftener than the normal schedule, namely, every three hours,—seven feedings in twenty-four hours,—and remember, increase *very slowly* and *cautiously*. By *no means* give him everything in one day, or *large quantities* of any particular food.

## CLINIC II.—BABY 11

Mother says the child is much better and happier. His bowels move only three times daily.

*Weight.*—Seventeen pounds ten ounces, showing a gain of *one pound four ounces* in the last week.

*Temperature.*—98.8° F.

*Examination.*—Looks better, brighter, and happier.

**Discussion.**—Considering the above gain in weight, we don't need to complain about the therapeutic results in this case. The child now is eating a little egg, potato, meat, Graham crackers, cereals, and milk, and seems on the road to complete recovery.

*Directions.*—Put him on five feedings.

## CLINIC III.—BABY 11

Mother sends in report that baby is doing nicely.

## CLINIC I.—BABY 12

Dr. H. H. Ogburn (Greensboro)

*History.*—Baby is three months old. Family and past history negative. The baby was breast fed every two hours since birth; was always hungry, always fretful, never thriving; he has no diarrhea, but is puny and not gaining.

*Temperature.*—97.4° F.

*Weight.*—Six pounds twelve ounces.

*Examination.*—This shows a baby of the typical decomposition type, with wrinkled skin and cold hands and feet.

*Diagnosis.*—Although the appearance is that of decomposition, we have learned in breast-fed children to establish the diagnosis rather of inanition.

*Directions.*—Having, by examination and tests, ruled out conditions other than feeding, we'll treat this child as a case of inanition. We'll order seven nursings in twenty-four hours, the mother to allow the child five minutes for the breast and then ten minutes for the bottle. We don't know how much this child will take in each bottle, but, as a guess, two ounces. This would make a formula of, roughly—

| | |
|---|---|
| Milk | 7 ounces |
| Water | 8 ounces |
| Dextri-maltose | 4 teaspoonfuls |
| Seven bottles. | |

## CLINIC II.—BABY 12

*Age.*—Three months one week.

Mother says the child is better, cries less, and seems happier. The bowels are still loose, however—about three a day.

*Weight.*—Seven pounds four ounces. Gain of eight ounces in a week.

*Temperature.*—97.8° F.

*Examination.*—Looks better.

*Directions.*—As this is such an excellent gain in this puny child, we'll make no change.

## CLINIC III.—BABY 12

*Age.*—Three months two weeks.

Mother says the baby has four or five green, watery bowel movements each day. He doesn't desire much food and has been peevish and irritable.

*Weight.*—Seven pounds four ounces, showing no gain this week.

*Temperature.*—98.2° F.

*Examination.*—Negative. There is no parenteral infection, and the child doesn't look unhappy. The skin, however, isn't quite as fresh looking as last week, and there are suggestions of rings under the eyes.

**Discussion.**—Gentlemen, here we have one of the conditions in which perplexity may arise. Are these watery, green bowel movements of significance or are they not? The weight curve during this week is perfectly straight. Is this due to underfeeding, and will the curve and stools improve upon increase of diet, or have we a beginning dyspepsia? The fact that he doesn't desire food makes us cautious, and I think it wiser to hold him as he is. The fact that he gained well last week—eight ounces—makes us in no particular hurry, and if this be an incipient dyspepsia, due to some outside factor,—possibly a cystitis,—it is wiser to make no change for a few days and note the reaction. Meanwhile we await urinalysis.

*Directions.*—Mother must be very careful to feed the baby just exactly as we directed, and if he doesn't want all his food, take the bottle from him. Don't force it!

Bring him next week.

## CLINIC IV.—BABY 12

*Age.*—Three months three weeks.

Mother says baby is much better but seems hungry. Stools are three a day and a little loose.

*Weight.*—Seven pounds twelve ounces, showing a gain of eight ounces in the last week—really in two weeks.

*Temperature.*—98° F.

*Examination.*—Child looks fresher. Urine reported negative.

*Directions.*—As there was no gain in the previous week, and

as he seems hungry and is well in every other respect, I think we are justified in increasing slightly. Let's give, in addition to the breast,

| | |
|---|---|
| Milk | 9 ounces |
| Water | 9 ounces |
| Mellin's Food (as the mother cannot get dextri-maltose) | 6 teaspoonfuls |

Seven feedings.

### CLINIC VI.—BABY 12

*Age.*—Four months one week.

The baby is happy in every way and doing nicely.

*Weight.*—Eight pounds eight ounces, showing a gain of twelve ounces in two weeks.

*Temperature.*—98.6° F.

*Examination.*—Child looks bright, happy, and contented.

*Directions.*—No change.

### CLINIC I.—BABY 13

Dr. Ed. King (Statesville)

*Age.*—Three months.

*History.*—Family and past history negative. Twelve other children living and well. The baby is brought for vomiting, which has persisted since birth. He gets the breast every half-hour.

*Temperature.*—97.6° F.

*Weight.*—Nine pounds.

*Examination.*—A fine, healthy, happy baby.

**Discussion.**—Persistent vomiting since birth makes us think of pyloric stenosis. However, if such were the case, the child's nutrition would be markedly affected. One look rules this out. Vomiting from parenteral infections wouldn't have persisted so long. I'm inclined to think the vomiting is due to the improper technic of feeding. Perhaps the baby is underfed and mother puts him to the breast every half-hour to appease him. Of course, continual insult to the stomach makes it rebel.

*Directions.*—Let us put him on regular nursings—twenty minutes every three hours, seven feedings in twenty-four hours—and await the reaction.

### CLINIC II.—BABY 13

*Age.*—Three months one week.

Mother says baby has ceased vomiting, but is very constipated, fretful, and peevish.

*Weight.*—Nine pounds, showing no gain this week.

*Temperature.*—97.6° F.

*Examination.*—No change.

**Discussion.**—Failure to gain, with no vomiting, no diarrhea, and with constipation, establishes the diagnosis of *inanition.*

*Directions.*—Add after nursing:

| | |
|---|---|
| Milk | 4 ounces |
| Water | 4 ounces |
| Sugar | 1 teaspoonful |

Seven bottles.

### CLINIC III.—BABY 13

*Age.*—Three months two weeks.

Baby still hungry—no vomiting.

*Weight.*—Nine pounds two ounces, showing a gain of two ounces in a week.

*Directions.*—Increase diet to—

| | |
|---|---|
| Milk | 8 ounces |
| Water | 8 ounces |
| Sugar | 3 teaspoonfuls |

Seven bottles.

### CLINIC IV.—BABY 13

Mother sends in report that baby is doing very well indeed and seems satisfied and contented.

### CLINIC I.—BABY 14

Dr. A E. Bell (Mooresville)

*Age.*—Four months.

*History.*—Family and past history negative. Baby was breast fed for one month. Mother lost her milk and gave Mellin's Food with cow's milk. Due to work in the fields, she has never given him proper care, leaving him to grandmother,

who doesn't know definitely the details of the diet. The baby was brought to Dr. Bell a few days ago on account of severe diarrhea, with green, watery, sour-smelling stools containing mucus and curds. Although this was an acute attack, the child had been ailing for a long time. He is better now, but still very weak.

*Weight.*—Seven pounds—less than when he was born.

*Temperature.*—97° F.

*Examination.*—Physical examination other than extreme emaciation and weakness is negative. Pirquet and urinalysis are negative. The family history gives no reason for suspecting lues. It is a case of marked decomposition.

*Directions.*—In such an extreme case we prefer infinitely breast milk or albumin milk. An ordinary milk mixture is far less efficient. Indeed, I doubt whether we shall accomplish much.

*Question.*—Grandmother, is there any possibility of getting any breast milk from your neighbors?

*Answer.*—Yes, Mrs. Miller just had a new baby and I might get a little from her.

*Question.*—Do you suppose that you could get an ounce every two hours?

*Answer.*—I think so.

Well, then, give the baby an ounce at 6, 8, 10, 12, 2, 4, 6, 8, 10 o'clock and once or twice during the night. Be sure to warm the milk to body temperature before using, and feed the baby absolutely regularly. Don't let him have the bottle over ten or fifteen minutes.

**Discussion.**—Gentlemen, this child is sick enough to need stimulation. He would be better in a hospital. Failing such, I doubt if we'll be able to accomplish much in the home.

We know that proper care and proper nursing are equally as important as certain formulæ. I have grave fears,—as you yourselves probably have,—after noticing grandmother's hostile demeanor,—that our instructions may not be carried out. Whenever grandmother looks skeptical, she probably intends introducing methods of her own. I don't believe she approved of our advice.

**CLINIC II.—BABY 14**

*Age.*—Four months one week.

Grandmother states baby is better, that his bowels are all right and his appetite good.

*Weight.*—Seven pounds four ounces, showing a gain of four ounces in one week.

*Temperature.*—98° F.

*Examination.*—No change.

**Discussion.**—Gentlemen, you remember last week we discussed the importance of care in the home, and wondered how frequently our directions really were carried out. It always is interesting to learn if baby really has improved on our feedings, or if some change of diet which the nurse never admits is the fundamental reason.

*Question.*—Grandmother, tell us just exactly what you gave the baby.

*Answer.*—Well, doctor, to tell the truth, I was able to get more breast milk from Mrs. Miller than I thought; so I gave the baby four ounces instead of one.

*Question.*—How often did you give this, grandmother?

*Answer.*—Well, I tried to give it every two hours.

*Question.*—You don't mean that you gave the baby four ounces every two hours?

*Answer.*—Perhaps not every two hours, but somewhere near there.

*Question.*—How much are four ounces?

*Answer.*—I didn't measure exactly, but Mrs. Miller said she thought there were four ounces. It quarter filled my glass.

**Discussion.**—Gentlemen, you see how many factors come into infant feeding, and how often we draw absolutely false conclusions. In this instance grandmother says she offered four ounces, but probably the baby got only two. One fact remains, however, the baby gained. For this let us be grateful; so, as long as he's gaining, we'll be justified in violating dogmatic routine and continuing the amounts which grandmother offers. I believe you will agree with me that in this case it is impossible to demand an exact routine. So, grandmother, as long as the baby is gaining, feed him as you are doing, but try to be regular, and measure

in the bottle just how much you are giving, because that will help us greatly. Try to feed him every three hours—6, 9, 12, 3, 6, 9 o'clock, and once during the night, and tell us next week how many ounces he takes, as you measure it in your bottle.

### CLINIC III.—BABY 14

*Age.*—Four months two weeks.

Grandmother says the baby is better.

*Weight.*—Eight pounds, showing a gain of twelve ounces in the week.

*Temperature.*—98.4° F.

*Examination.*—Negative. Notice how much fresher and happier he looks, and, above all things, notice the returning elasticity to the skin and the decided change in color. This child is doing nicely.

*Question.*—Grandmother, how are you feeding the baby?

*Answer.*—I am feeding him just exactly as you told me. He seems satisfied, and I think he's much better.

He gets three ounces each feeding.

### CLINIC IV.—BABY 14

*Age.*—Four months three weeks.

Grandmother says the baby is doing as well as can be expected. He seems more cheerful, but she can't see much change in his weight. Bowels move two or three times a day.

*Weight.*—Eight pounds four ounces, showing a gain of four ounces.

*Temperature.*—98.6° F.

*Examination.*—Baby looks better.

**Discussion.**—Well, gentlemen, we didn't expect a very noticeable change in such a tiny baby, but the scales show a gain of four ounces. This isn't bad.

*Question.*—Grandmother, what have you been giving this week?

*Answer.*—Well, I can only get breast milk once in a while, and so I gave five ounces whenever I could get it, and the rest of the time condensed milk.

*Question.*—How much breast milk did you give him in twenty-four hours?

*Answer.*—I don't think I got much more than five or ten ounces.

*Question.*—And the rest of the feeding was condensed milk, was it?

*Answer.*—Yes.

*Question.*—How much in each bottle?

*Answer.*—I guess about five ounces.

**Discussion.**—You see how careful we must be at all times. If we hadn't learned this, we should have attributed this gain to breast milk and would have been pleased. You remember the dangers of condensed milk—how a child gains temporarily from the high amount of carbohydrate, but that this gain represents water-logging of the body rather than true gain in tissue substance. So, although he apparently put on four ounces, we're not satisfied. If we must use artificial food, let us use a regular milk mixture.

Doctor, will you explain to grandmother during the week the dangers of condensed milk feeding and let us figure on a milk mixture of—

| | |
|---|---|
| Milk | 10 ounces |
| Water | 22 ounces |
| Dextri-maltose | 8 teaspoonfuls |
| Seven bottles. | |

This will make seven feedings in twenty-four hours, of four and one-half ounces each—a little more than I ordinarily would order, but as grandmother has been giving five ounces every three hours, I think we're safe. I'd give just as much breast milk as possible at each feeding. Then offer a bottle for ten minutes. Let him take as much as he wishes, and after ten or fifteen minutes, if he hasn't finished, take it away and make him wait until the next feeding time.

## CLINIC V.—BABY 14

*Age.*—Five months.

Grandmother says he is better, but hungry.

*Weight.*—Eight pounds eight ounces, showing a gain of four ounces in the week.

*Temperature.*—98.4° F.

*Examination.*—No marked change.

**Discussion.**—Gentlemen, in a child as poorly nourished as this one we mustn't push feedings too rapidly, particularly where we're not sure of the nursing coöperation in the home. I believe as long as he's gaining we should leave him for two or three days, and then, if he seems very hungry, we might increase to perhaps—

| | |
|---|---|
| Milk | 13 ounces |
| Water | 19 ounces |
| Dextri-maltose | 8 teaspoonfuls |

Seven bottles.

and perhaps toward the end of the week—

| | |
|---|---|
| Milk | 15 ounces |
| Water | 17 ounces |
| Dextri-maltose | 8 teaspoonfuls |

Seven bottles.

## CLINIC VI.—BABY 14

*Age.*—Five months one week.

The baby had a diarrhea this week, but now bowels move only once or twice a day. Careful questioning shows that grandmother overfed the baby, and of herself removed food, thus treating successfully the resulting dyspepsia.

*Weight.*—Eight pounds four ounces, showing loss of four ounces during the week.

*Temperature.*—98° F.

*Examination.*—No change.

*Directions.*—Continue to feed the baby as ordered, giving—

| | |
|---|---|
| Milk | 15 ounces |
| Water | 17 ounces |
| Mellin's Food (as grandmother can't get dextri-maltose) | 1 ounce |

Seven bottles.

### CLINIC VII.—BABY 14

*Age.*—Five months two weeks.

The diarrhea has gone, and the bowels move once a day and are hard. The baby is hungry, however.

*Weight.*—Eight pounds three ounces, showing a loss of one ounce during the week.

*Temperature.*—98° F.

*Examination.*—No change.

*Directions.*—Increase the feeding to—

| | |
|---|---|
| Milk | 18 ounces |
| Water | 16 ounces |
| Mellin's Food | 9 teaspoonfuls |

Seven feedings.

### CLINIC VIII.—BABY 14

Child much better.

*Weight.*—Eight pounds twelve ounces, showing a gain of nine ounces in the week.

*Directions.*—No change. In a few days start cereal.

### CLINIC I.—BABY 15

Brought by Dr. W. P. Knight (Greensboro)

*Age.*—Two years two months.

*History.*—Family and past history negative. The complaint is very marked constipation. The child wouldn't have a bowel movement oftener than every three or four days if castor oil or enemas weren't given continually.

*Weight.*—Not taken.

*Temperature.*—98.8° F.

*Examination.*—Negative.

**Discussion.**—Gentlemen, in trying to diagnose the cause of this condition let us think of the simplest things first. Let us see exactly what baby has been eating.

*Question.*—Mother, how do you feed the baby?

*Answer.*—I give him meat, one and sometimes two eggs a day, a little broth, some toast, once in a while some corn-starch or Cream of Wheat, and once or twice a week a baked apple.

*Question.*—Don't you give him anything else?

*Answer.*—No.

*Question.*—Don't you give him any vegetables?

*Answer.*—No, my book on feeding said I shouldn't use any vegetables until he was over two years of age.

**Discussion.**—Gentlemen, you see how simply we meet many of the problems in pediatrics? You see the value of a little simple physiology? Remember, in the early lectures we spoke of fermentation and putrefaction. Meat and eggs, which form a large part of this baby's diet, are protein and cause an alkaline intestinal reaction. The carbohydrate which the baby gets is of the starchy type, and normally will not produce much fermentation. Again, there are no vegetables—not enough cellulose to leave a residue in the intestines. I think the treatment is to put this child on a perfectly full diet, perhaps reducing the meat and eggs *slightly*, giving more cereal, particularly oatmeal. By all means give plenty of vegetables, even the coarser ones, such as mashed cabbage and turnips. Give baked apple or apple-sauce every day, all kinds of stewed fruits, and, in short, feed the baby almost everything that you would feed an adult, with the exception, of course, of the very heavy things, and with the provision that whatever you give must be cut up fine. I would lay particular emphasis upon vegetables and stewed fruits. Graham crackers are considered laxative.

Now, of course, this baby won't react tomorrow, and so, until we get him adjusted, he will be constipated. Under these circumstances let him go for perhaps two days, and then give an oil enema. Under no circumstances give him any more purgatives.

A valuable aid in children of this age is a combination of raw prunes, dates, figs, and raisins. These are put through a meat-grinder, or finely chopped in a chopping bowl, and formed into little candy balls. Roll them in a little powdered sugar and they look like candy.

In this case we may need some malt soup extract and may be some mineral oil also.

## CLINIC I.—BABY 16

Brought by Dr. C. W. Woodson (Salisbury)

*Age.*—Fifteen months.

*History.*—Negative except for the following: The child received the breast for fourteen months, plus a mixed diet from the eighth. After thriving until ten months he developed measles and whooping-cough. During the following weeks he lost weight and became puny, but his bowels were all right. Then he got a severe diarrhea, with some blood in the stool. The family physician treated him with broth and albumin water for five days. Although the *diarrhea stopped,* he got *much worse* on this diet. Another physician was called, who ordered a full diet. The child again grew worse, vomited, had severe diarrhea, and lost rapidly. The parents, in desperation, took him to a neighboring city. Here for four days the doctor ordered large quantities of oatmeal water and buttermilk. He received nothing else during that time and gained rapidly. Two or three days ago another doctor was called. Although the child had gained at an enormous rate, he was very, very sick. He was suffering severe diarrhea, temperature was 97° F., and the whole body was edematous. The last physician ordered albumin milk. On this he has lost much of what he gained.

*Temperature.*—97° F.

*Weight.*—Ten pounds.

*Examination.*—This shows a terribly emaciated child—the worst we have seen. Diffuse râles are present throughout the chest.

**Discussion.**—Gentlemen, is this a case of *decomposition* due to various factors, or is it *miliary tuberculosis?* In favor of tuberculosis is the history of measles and whooping-cough and the clinical picture, with the râles throughout the entire chest. Against this diagnosis are the absence of an enlarged liver and spleen and the absence of dulness upon direct percussion over the spine—from enlarged bronchial glands. A Pirquet here would not help us because, if this is tuberculosis, it is of the miliary type and would give a negative reaction. The only sure way is to introduce a cotton swab into the larynx, obtain sputum when the child coughs, and make smears.

In favor of decomposition of the mixed type we have the history of all sorts of irregularities in feeding, improper diets, starvation, recently one-sided carbohydrate feeding, plus the secondary influences of parenteral infections, as measles and whooping-cough, and even possibly definite enteral infection when blood appeared in the stools. The cough might simply be a bronchitis secondary to the child's weakened condition.

The subnormal temperature doesn't help us, for it may be present in either alimentary decomposition or in the collapse of a miliary tuberculosis.

In either case, however, whether it is a decomposition due to tuberculosis or to alimentary factors, the child must be fed. Our feeding technic will be the same as in decomposition.

*Directions.*—Let us keep him on albumin milk with 3 percent dextri-maltose. Let us offer protein in the form of soft-boiled egg, cottage cheese, curds of milk. Let us offer carbohydrate, as mashed potato, zwieback, and corn-starch.

Of course, remember to be *very, very careful* as regards quantity, and certainly not start more than one new food on the same day. I believe he is so sick we might try three-hour feedings.

Give the child all the water he wants to drink, and you may have to stimulate him.

Let us see him next week if he is still with us.

## CLINIC II.—BABY 16

*Present Age.*—Fifteen months one week.

*Present Weight.*—Twelve pounds nine ounces, *a gain of two pounds nine ounces in one week.*

Mother says the child is improved in every way. He is brighter, happier, his voice is stronger, and sometimes he smiles. She has noticed his great gain. He likes his food and wants more.

*Examination.*—Shows a decided improvement. There is a suggestion of returning elasticity to the skin, and the muscles, too, begin to feel more like the normal. Doctor reports smears negative for tubercle bacilli.

**Discussion.**—Gentlemen, from the standpoint of our course, this case makes a most excellent conclusion. Within the last

months has arisen almost every complication possible in the course of infant feeding. Let us picture the course of this child by the following curve (Fig. 38):

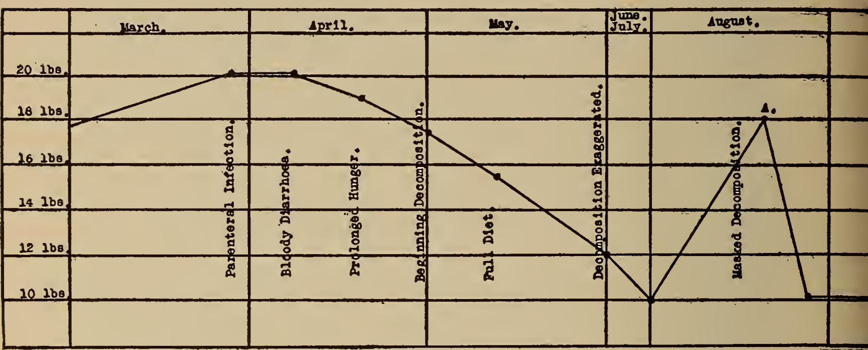


Fig. 38.

He was doing nicely until he suffered a parenteral infection. Due to this, his nutrition suffered and he ceased to gain. A severe diarrhea complicated the picture. We can't say whether this was an infectious diarrhea or one resulting from the parenteral infection. The presence of bloody stools makes us suspect the former. The weight curve suffered. The physician treated *the stool* and ordered nothing but a starvation diet for five days. The stool improved, but the factor of severe hunger, added to the previous injuries, undoubtedly was sufficient to reduce the child to a condition of decomposition. Now, the physician not recognizing the fundamentals of the case, ordered a full unrestricted diet. This additional insult reduced the child still further and he was taken out of town. In a neighboring city, a mixture high in water, carbohydrate, and salt was ordered. The gain in weight was phenomenal, but, gentlemen, this gain in weight was not one of true tissue substance, but was one of water. The condition of decomposition was not cured, but was masked. The water-logging of the body was extreme—great enough to produce a marked edema. The water, however, was bound only very loosely to the tissues. The baby was in a critical condition, with subnormal temperature and slow, feeble

pulse. The feeding then ordered, *i. e.*, albumin milk, a mixture low in salts, low in sugar, just *the reverse* of the previous, caused a *complete reversal* of the reaction. The organism squeezed out the excess of fluid with which it previously had been filled, and the baby was in a condition identical to that when he left town. The feeding instituted last week, taking into consideration the *needs of the body tissues*, answering them with a combination not injuring the intestinal tract, has apparently worked wonders. I believe this child will recover. I am very proud of this result, gentlemen, and I should advise you to copy this curve and study it carefully. In it you have a summary of our entire course.

*Question by Dr. Flippen.*—Before concluding this part of the course, would you mind stating precisely once more just what significance you place upon stool examination?

*Answer.*—Gross examination of the stool will aid us, first, in distinguishing the infectious from the nutritional types of diarrhea. The infectious types usually are associated with blood, mucus, pus, and rather small, solid contents of the stool. The nutritional types only rarely show blood or pus. Dysentery causes alkaline stools; nutritional diarrheas, usually acid. Having ruled out infectious disturbances, the condition of the stool, whether constipated or diarrheal, is of value.

The constipated stool in many cases may mean insufficient food or insufficient fermentable carbohydrate, allowing putrefactive processes to predominate, or may mean simply insufficient residue in the intestinal tract from excessive resorption of the food. It must be considered only in connection with the child's weight curve. If the child is gaining, the stool has little significance.

The diarrheal stool usually signifies excessive fermentation in the child's intestinal tract. Whether this fermentation be due to a high carbohydrate-whey mixture, to parenteral infections, to heat, to overfeeding, or to other factors, our history and examination will disclose. I believe I've made the comparison of diarrheal stools to coughs. If the baby coughs once or twice a day, we accept this as evidence of irritation of the respiratory tract, but don't get excited. If he coughs more frequently but has no fever and is still subjectively well, we assume that the respiratory irritation is worse, but still are not alarmed,

because the *child himself* is not suffering. However, when he not only coughs severely, but also shows other reactions, as fever and general disturbance, then we know that the infection is sufficient to affect the baby as a whole. So it is with these diarrheal stools. When the child's weight curve is unaffected, when the child clinically is well, we pay little attention. Indeed, we know these stools may be symptoms even of underfeeding, but if the child, on the other hand, appears sick, shows changes in his general behavior and conduct, is fretful, and, above all things, shows changes in the weight curve which are so significant of the baby's general condition, then we know that the conditions in the intestinal tract are sufficient to affect the baby as a whole.

So, gentlemen, stool examination in these conditions is of importance, but it is of importance only as a symptom, and must be studied not by itself, *but only in connection with baby's history, present condition, general conduct, and, by all means, in connection with his weight curve.*

## CONCLUSION

Gentlemen: This concludes the main chapters of the course. These lectures and clinics have leaned possibly a little more to the scientific, a little less to the practical. This was absolutely intentional on my part. To attempt to teach you, with your years of experience the *practice* of medicine would be absurd. You know better than I the little devices, the various forms of psychotherapy, that sustain and satisfy anxious patients. In inanition, if the mother thinks her breast milk not good, satisfy her by obtaining a specimen for examination. In a case of overfeeding, if the child vomits, give a little placebo, besides correcting the diet. In dyspepsia order a mild mixture for the bad stools. Only in families of the highest type can you practise your profession without some sort of a prescription. In the city, as well as in the country, patients want medicine. In this course, however, I have omitted all these details because I wanted to show you the clear, distinct reactions. The disapproving glances of our good nurses, the disappointment of the parents, and even your own criticisms have not escaped me,

but I paid no heed, for I wanted to teach *you* what I consider the *truth.* I wanted to feel that after the conclusion of this course no one would be justified in completely overlooking some of the essentials in diet and saying, "Such and such a result was due to a stomach washing, a colonic flushing, a dose of castor oil, or what not, given coincidentally with the change of food." We have attempted, one might say, a laboratory course, untrammeled by any factors which might cloud the pictures. Usually a haze separates us from our patients, a haze made of false conclusions derived from superficial examinations and from blind adherence to antiquated texts; a haze invoked by superstitious grandparents, and, as I understand it, even by some of your newspapers and by some of your clergy in their unthinking recommendation of proprietary and secret remedies. I have tried to clear away this mist; to reveal the patient clear and distinct before you; to show you the truth, as I see it. Having mastered the *science* and *truth* of medicine, you may, if necessary, adopt the various devices of practice with impunity. Use them, but don't let them blind you.

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